# AMATEUR RADIO 73

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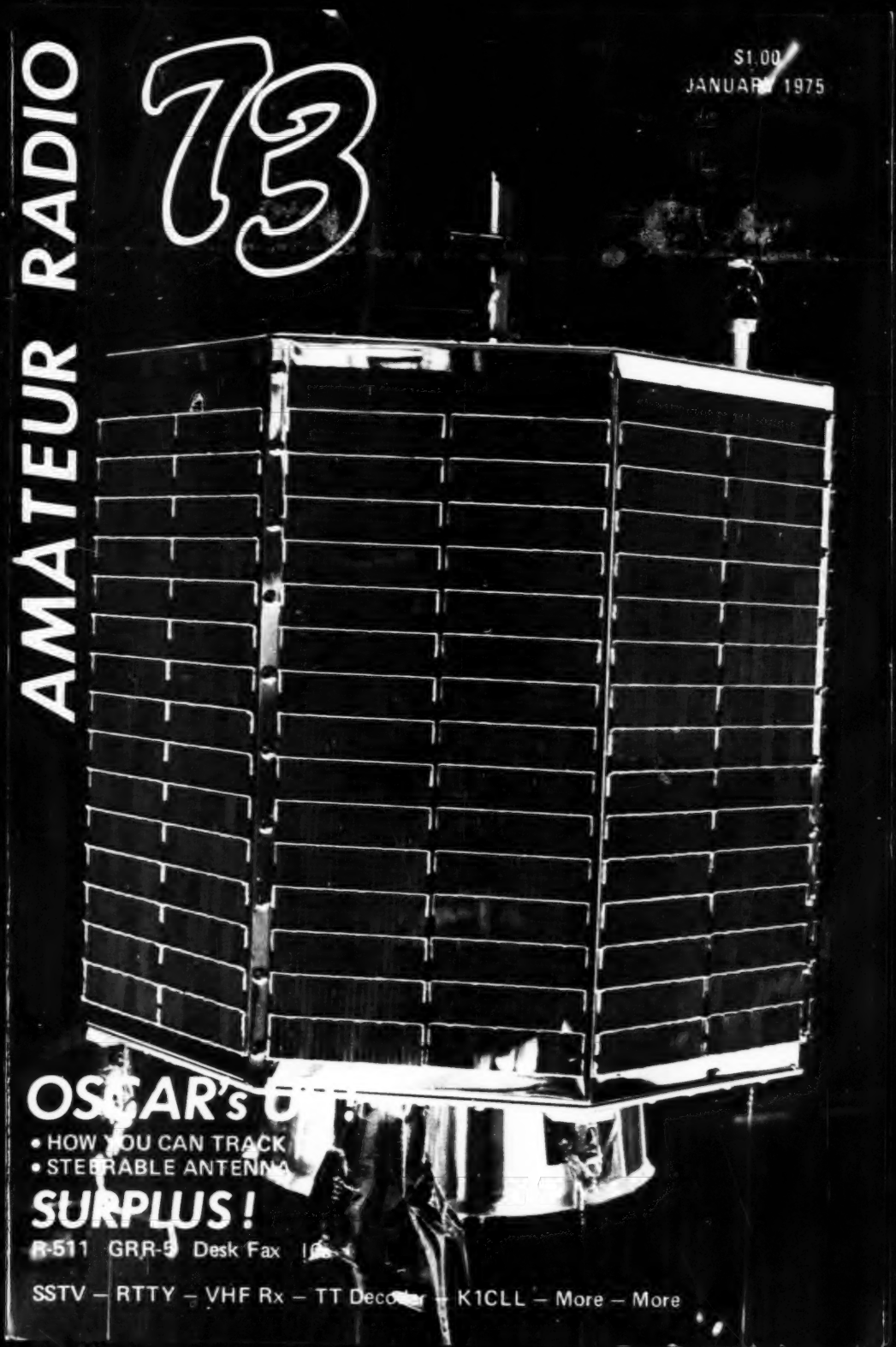
JANUARY 1975



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# 73 AMATEUR RADIO

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*Cover photograph courtesy of ATEC*
*Submitted by Perry Klein*

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# 73 Staff

**EDITOR/PUBLISHER**
Wayne Green W2NSD/1
**BUSINESS MANAGER**
Virginia Londner Green
**EDITORS**
Alex Barvicks WB4RVH
John Burnett
**PRODUCTION MANAGER**
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*Interior decoration by Henderson's Creative Work*

*EDITORIAL BY WAYNE GREEN*

## ARRL BANDPLAN

The recently released ARRL Official Bandplan for the 450 MHz band has stirred up quite a controversy.

Critics of the "plan" say that it was put together with too little knowledge of the problems involved in allocating channels in that band. Some critics say flat out that politics were involved much more than common sense.

The ARRL plan calls for 450 repeaters to have their inputs on the high end of the band from 445-450 MHz. "Insane," say repeater operators in the major metropolitan areas. They point out that the signals and intermod from commercial repeaters just above the 450 band all fall within this segment of the band and putting the amateur repeater inputs there is just asking for troubles which are insolvable.

By putting the repeater inputs in the 440-445 MHz part of the band you get away from most of these interfering intermod products.

It is being pointed out that many repeater groups have tried the repeater outputs on the lower segment and have come to grief as a result.

Frequency coordinators also are alarmed over the ARRL proposal because it would put the 450 repeater inputs right on the second harmonics of the 224 MHz repeater output second harmonics. This alone, without considering the commercial repeater intermod problems, should be enough to scuttle the input-high scheme, they feel. Second harmonic output can be kept down, but there is no way to completely eliminate it. . .and this means coordinators will have to allocate 220 MHz repeaters so they won't interfere with 450 repeaters! Or should all of the 220 repeaters be inverted just so the ARRL 450 bandplan can be accepted?

Some standardization is needed since about half of the 450 MHz repeaters are low in and half are high in. It would seem that the League went off half-cocked on this one and more data should be gathered before a plan is pushed on repeater groups. Experienced repeater designers feel that any objective review of the evidence can only result in the East/West Coast plan being accepted instead of the Texas Plan – low in/high out.

## HOTLINE MAIL

A good deal of the mail in recent weeks has been complimenting the job 73 has been doing with the bi-weekly Hotline report. To tell the truth the newsletter is fun for us at 73 to write and publish. The two month long deadline for 73 is so restrictive that little real news can be considered – it takes almost two months, when everything works smoothly, for something to get from a writer to the readers of 73 Magazine and that kills news of most DXpeditions and emergencies.

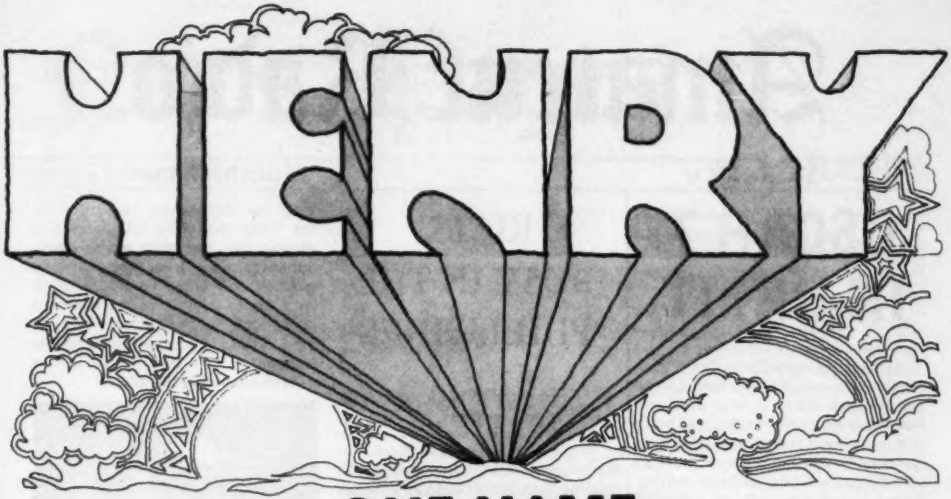
While the readership of the Hotline is a lot smaller than 73, numbering about 4000 subscribers plus nearly a thousand ham club bulletin editors, the eventual circulation of news is substantial since a great many of those editors reprint material from Hotline to help flesh out their club bulletins and make them a bit more up to the minute. Also, when you consider that the large part of the readership paid out $8 for a year of Hotline, so we know they are really active and enthusiastic hams. . .the kind it is enjoyable to write for.

In the mid-November issue we had news reports on a wide variety of items. There was the WB6JPI 15 kHz plan for permitting splinter repeaters to work with little or no interference to or from the 30 kHz repeaters adjacent to them – sheer genius, obviously. This was the scheme adopted by the first WR6 splinter channel repeaters authorized by the SCRA at the San Diego convention – all reported in this issue of Hotline.

Looking West editor Pasternak had a great story about PARC in L.A. finding a thief and getting him arrested when he turned up on the repeater. He had another about a tower law in L.A. being defeated by the hams. The moonbounce gang made it again, with details in Hotline. . .using a portable station, no less! DX news featured stories on the gang going to Navassa, the ZM7 operation, VP8MS on South Georgia, Trinidade and Chad. . .plus a good possible new country, Hutt River Province.

73's propagation expert has a special sunspot and DX report – the latest Walker news on the coming restructuring of the rules – petitions for RTTY code changes, for six meter

*Continued on Page 117*

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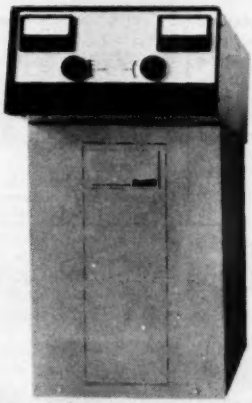

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# Amateur Radio



## OSCAR 7 IN ORBIT

After the usual series of delays they finally got everything working at once and booted Oscar 7 into orbit on November 15th. While you still can't pick up a hand transceiver and talk to someone over Oscar, the techniques of making contact via satellite are getting better known and a lot of amateurs are having a real ball using it. In addition to a series of articles in 73 on how to find and use Oscars 6 and 7, you'll find late info in the Amsat column in the newspages.

## *Licence Manual For Handicapped Planned*

W1GVW/4 plans to publish a license manual for handicapped persons who are interested in becoming licensed amateurs. If you are a handicapped, deaf, or blind ham, or have worked with one, please send information concerning your experience, and pictures if you have them to: Ted Edwards W1GVW/4, Virginia Theological Seminary, Alexandria VA 22304.

## K1CLL BUSY IN THE PHILLIPINES

Bill Hoisington K1CLL, one of the ham fraternity's most original and prolific writers, is busy with a number of projects in Rizal, Philippines. His lovely wife, Pilar, who is trying to keep up with Bill's paperwork, writes that not only does Bill have some backers to produce some of his "brain children" but that he is connected with the engineering department of the State University and is writing regularly for one of its more esoteric publications. He is still inventing and building and hopes to find time to write up his latest creations. Pilar sent along some color photos of Bill and they do seem to show that he has managed a little time in the sun in spite of his heavy schedule.

*Bill on the slope of the extinct volcano Mt. Makiling with a coconut grove behind him and a pile of jack fruit at his feet.*

*Bill and Pilar Hoisington.*

## F8EM

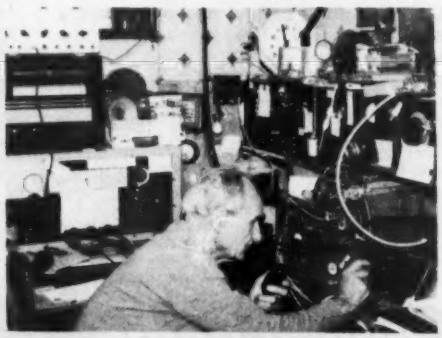
Well-known call on the DX bands is that of F8EM.

Near his QTH at COGNAC – where the best brandy comes from! – is a small river aptly named "l'antenne".

A former ship's "Sparks", Leo has been regularly on the bands since the twenties, and is a great believer in home-brew gear.

*Photos by G3KPO*

*Leo by the marker of his river.*



*Leo F8EM in his shack-all home brew!*

*Bill Pasternak WA2HVK/6*
*Associate 73*

# They Took Their Repeater With Them!

Every two minutes while the machine was keyed on, the voice of Bella Romain WA2CZU could be heard over the city of San Diego proclaiming: "This is a special events repeater station WR6FM San Diego, sponsored by the Palisades Amateur Radio Club of Culver City". Bella was some 3,000 miles away, but her beautiful voice and natural speaking talent would be a part of P.A.R.C.'s participation in the Southwestern Division Convention held November 1, 2 and 3rd 1974 at San Diego's fantastic Town and Country Hotel.

Not only did the P.A.R.C. contingent arrive with their own repeater operating on 146.01-146.61, the same channel as their Hollywood Hills based home system WR6ABB, but not to be outdone by the many organizations that sponsored "Hospitality Rooms," P.A.R.C. showed up with a "Mobile Hospitality Motor Home" thanks to "Uncle" Earl Surad WB6MUQ. Located in the hotel parking lot near the entrance, it was the first stop for many enroute to the festivities. It also served as talk-in for anyone who might venture onto .01-.61 and found as many users as the convention's own .34-.94 system. With close to 2400 amateurs in attendance, many others beside the P.A.R.C. people found it of value.

Credit for the success of WR6FM must be given to two individuals well known in FM circles out here. Strapping together a MOCOM 30, a Motrac, some control circuits and my Norelco Carry Corder was the handiwork of Neil McKie WA6KLA. There are times when I think Neil knows more about Motorola radios and what they are capable of doing than the people that designed them. While WR6FM was nothing pretty to look at, it functioned faultlessly for the three days of the convention; a tribute to the expertise of WA6KLA. This is the same repeater that Neil had used earlier this year to provide communication for the Baja 500 auto race South of the Border. At least this time he had 110 Vac to run it off. Receive antenna was a Ringo atop a 20' pole outside the hotel room and transmitting was accomplished with a ¼ wave whip clipped to a cabinet in the room. Though the system was effectively at ground level, it could be accessed from about the time San Diego was line-of-sight from the freeway and some amateurs told me that it was useable from downtown San Diego. Not bad for a portable system.

Ah, but I said that there were two people responsible for the success of WR6FM; someone had to apply for the license, do all the paperwork and hope it would be accepted by the FCC. That job fell on the shoulders of Fred Deeg K6AEH who is also licensee of WR6ABB. About six months ago Fred announced that he had applied for a special repeater call sign and permission to operate a portable repeater at the convention. It took a couple of months of nail biting but it finally came and P.A.R.C. was on it's way.

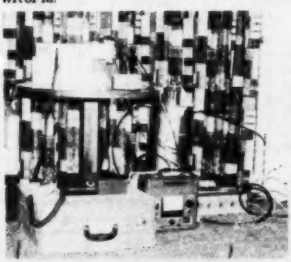
From all this you might get the idea that P.A.R.C. is a rather "together" active organization. You would be right. Lets face it, how many clubs take their repeater with them to an event such as this? P.A.R.C. does and S.A.R.O.C. is next. Hmmmmm, WR7FM?

Do P.A.R.C. people have more fun? Let the pictures speak for themselves.

*Some of the PARC contingent pose outside the PARC hospitality motor home provided by Earl WB6MUQ who is standing on the extreme left.*

*"Uncle Earl" WB6MUQ and Carl WA6JOW relax (party?) inside PARC hospital motor home between convention events.*

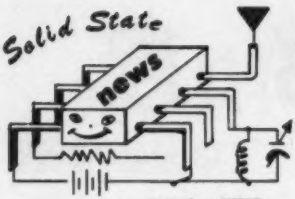
*Neil McKie WA6KLA and Fred Deeg holding the special temporary license for WR6FM.*



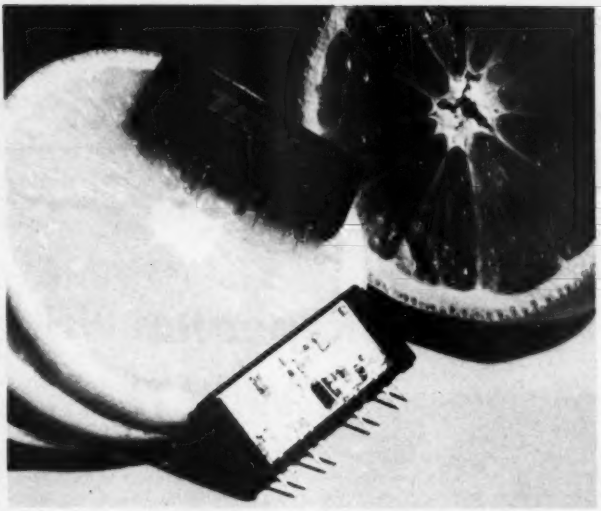
*It may not look like much, but thanks to the genius of Neil WA6KLA it outperformed the .34-.94 talkin machine.*

*Fred K6AEH, his wife Marsha WA6CUF and Larry K6YUI enjoy a last cup of coffee before the ride back to L.A.*

*Editor's note: payment for this article is being donated by the author to the PARC Repeater Fund.*




Walter Scott K8DIZ
7318 Hollywood Drive
West Chester OH 45069



*TRW MX1.5 broadband UHF power amp.*

One of the most useful pieces of test equipment around the shack is the multimeter. In the last couple of years the expensive digital version of the multimeter has come down in price to where some hams can afford to invest in one and measure their voltages, currents, and resistances much more accurately than ever before. Those who would be interested in building their own digital multimeter, either for fun or financial necessity, will be pleased with the 3½ digit Analog to Digital Converter set of ICs recently introduced by Siliconix. This pair of ICs forms the heart of a 3½ digit multimeter when combined with a clock oscillator, 7-segment displays, display drivers, power supply, and a switch selected voltage divider to determine the range of measurement.

The Siliconix LD110/LD111 A/D converter set offers high performance and versatility with a minimum of external circuitry. The set consists of a monolithic P-channel MOS digital processor (LD110) and a monolithic bipolar-PMOS analog processor (LD111). The features of the A/D converter set include an accuracy of ± 0.05% of the reading 1 count; a 4 pico-amp typical input bias current; an input impedance of greater than 1,000 Megohms; autozeroing; and a single reference voltage requirement. External user-selected components allow selection of two different voltage ranges (2.000 V and 200.0 mV). This is the basic full scale range of the multimeter. The range selector switch and its voltage dividers allow up to 5 decades of voltage measurement (200 mV to 2000 V). Also, a wide range of sampling rates can be selected (1/3 to 12 samples per second) to accomodate a variety of applications. Fig. 1 shows the functional block diagram of the LD110/111.

The monolithic LD111 analog processor contains a bipolar comparator, a bipolar integrating amplifier, two MOSFET input unity gain amplifiers, several P-channel analog switches and the necessary level shifting drivers to allow the analog and digital processors to be directly interfaced. All amplifiers are internally compensated.

The PMOS LD110 synchronous digital processor combines the counting storage, and data multiplexing functions with the random logic necessary to control the quantitized charge-balancing function of the analog processor. Seventeen static latches store the 3½ digits of BCD

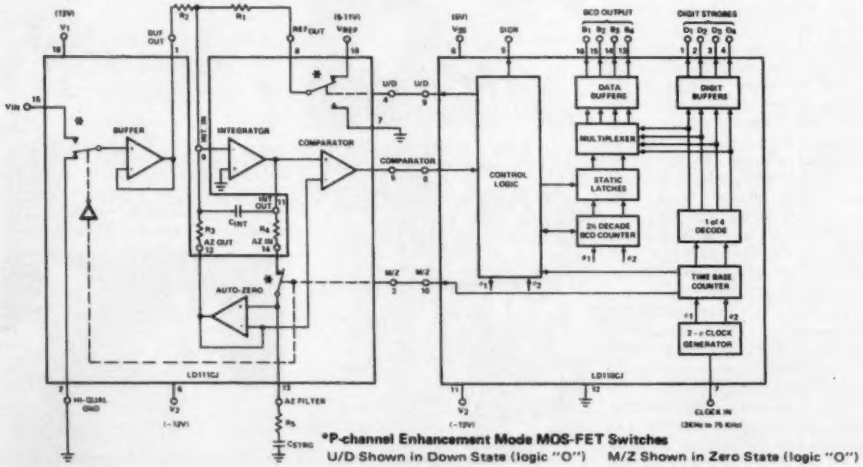



*Fig. 1. Functional block diagram of LD110/LD111.*

data as well as overrange, underrange, and polarity information. Nine push-pull output buffers (capable of driving one TTL load each) provide the sign, digit strobe, and multiplexed BCD data outputs. These outputs are all active high. The digits are scanned in an interlace format: 1,3,2,4.

The conversion technique is a form of dual slope integration. This method balances the charge supplied by a current proportional to the input voltage, over a measured time interval, with an accumulation of quantitized charges whose number equals the BCD count. The units of quantitized charge are provided through pulse width modulation of a reference current.

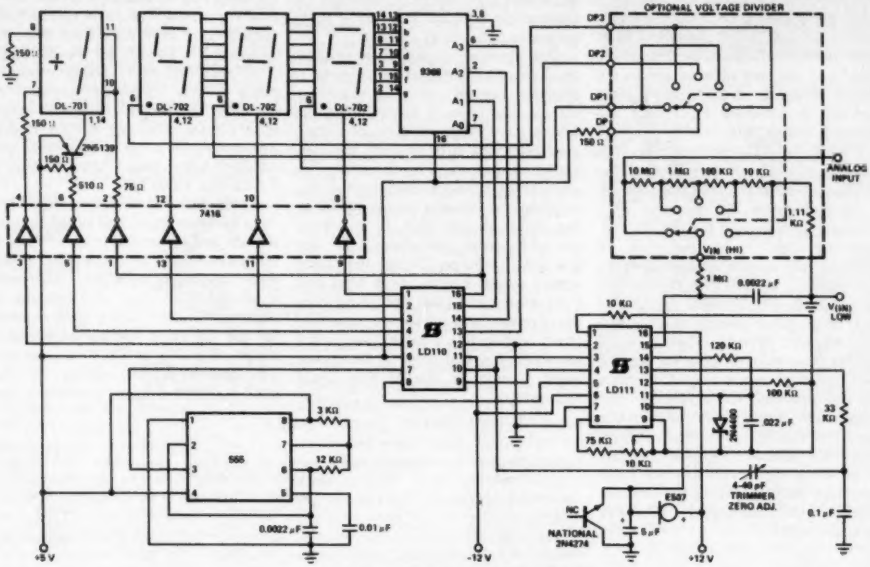



*Fig. 2. Digital voltmeter using LD110/LD111.*

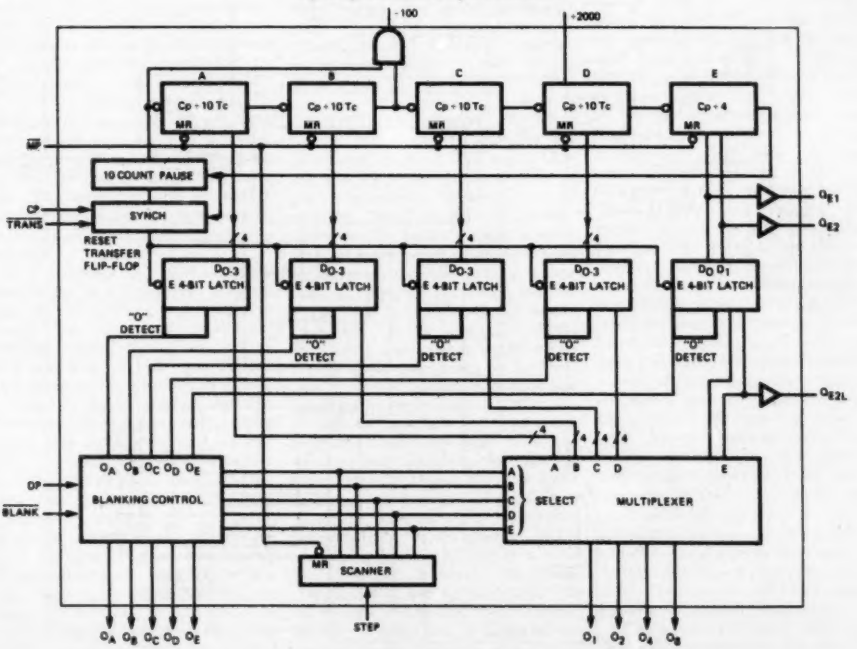



*Fig. 3. 3814DC DVM logic array.*

Fig. 2 shows a schematic of a DVM using the LD110/111. With the addition of some current shunts and a current source the DVM could become a DMM.

The 3½ digit A/D set of ICs is available from Siliconix for $40.85 in single quantities (LD110CJ – $18.35, LD111CJ – $22.50). An application note (AN74-1) and a design aid (DA74-1) are available to aid in the proper design of a DMM using these circuits. A complete PC layout and parts list is included.

Fairchild Semiconductor has developed a silicon gate device that contains most of the logic required for a 4½ digit DVM. All necessary BCD counters, latches, and the display multiplexing logic is on the chip. In addition, the control signals necessary for dual slope integration are generated by the 3814DC device. The BCD outputs can directly drive a BCD to 7-segment decoder. Zero suppression is generated on chip by feeding back the digit select output. Outputs are also provided for indicating overrange and underrange. A unique feature of the 3814DC is the incorporation of a 10-count pause at the start of an integration cycle to mask noise generated when switching the external analog circuits, such as the reference current source.

A reliable and accurate DVM circuit must be insensitive to long term changes of supply voltage, time base, and passive and active component values. It must be able to reject 60 Hz line noise. Dual slope integration achieves a high degree of accuracy by causing the effect of changes in these parameters to cancel.

One method of dual slope integration involves integrating a current directly related to the unknown voltage for a fixed period of time, followed by the integration of a standard reference current until the integrator output returns to zero. The amount of time required to null the integrator is directly proportional to the ratio of unknown to reference current and therefore, to the unknown voltage. Since the same system power supply, time base, and components are used for integrating the known and unknown currents, their absolute values are not extremely critical. Fig. 3 shows the block diagram of the 3814DC DVM logic array.

The 3814 is just the major portion of the voltmeter logic. The analog portion of the circuit is constructed using separate linear IC's. Fig. 4 shows a DVM circuit using the 3814. Range selection circuitry and power supplies are required in addition to the components shown. The DVM can be built with a total of 7 IC.s. Cost in single quantities is $16.50 for the 3814DC.

A new line of rf power modules from TRW Semiconductors is designed specifically for UHF handheld transceivers. The MX1.5 device operates from a 7.5 V battery in the 400-512 MHz range. Rated output is 1.5 W. (See table 1).

These broadband power amplifiers have 50 Ohm input and output impedances and are stable under all operating conditions of voltage and drive, and provide excellent harmonic suppression. A series of 4 modules is available for UHF and a 25 W module for the 2m band has just been introduced. The 7.5 to 25 W devices are packaged in a case similar to the MX1.5 except a flange is added to the

**TABLE 1**

| TYPE | FREQ. (MHz) | POWER OUT (W) | POWER IN (mW) | VOLTAGE (V) | % EFFICIENCY | SINGLE QTY PRICE |
|---|---|---|---|---|---|---|
| MX1.5 | 400-512 | 1.5 | 35 | 7.5 | 45 | $41.75 |
| MX7.5 | 400-512 | 7.5 | 125 | 12.6 | 33 | $46.00 |
| MX12 | 400-512 | 12.0 | 150 | 12.6 | 35 | $52.00 |
| MX15 | 400-470 | 15.0 | 200 | 12.6 | 35 | $56.00 |
| MV25 | 135-180 | 25.0 | 200 | 12.6 | 35 | |

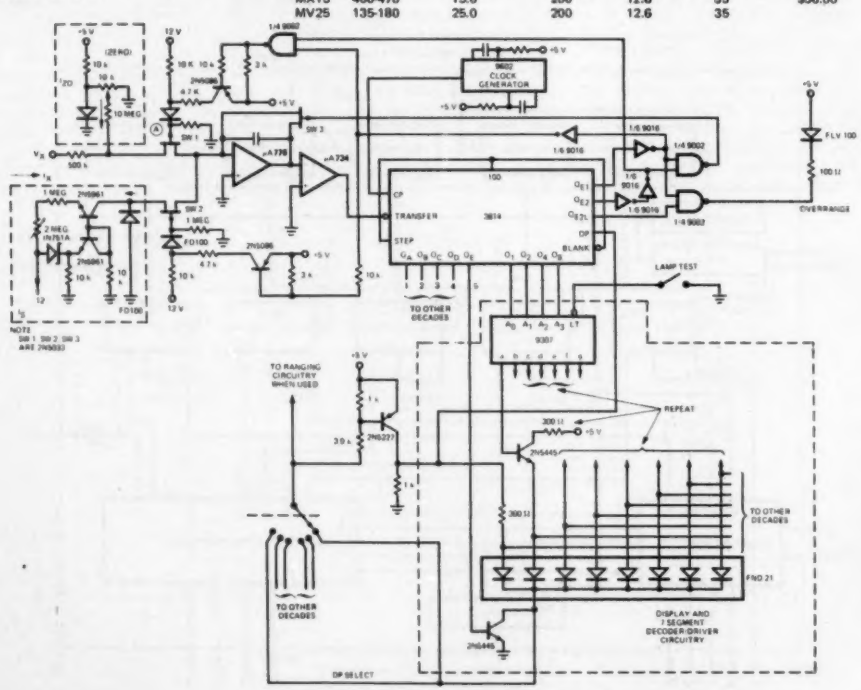



*Fig. 4. A DVM using the 3814DC.*

back of the case to allow bolt on mounting to a heat sink.

Harmonic suppression in excess of 30 dB and the capability to withstand infinite SWR are common to all modules. Use of these modules in a small FM rig would have several advantages over a discrete amplifier. Among them would be improved reliability, small size for the amount of gain avilable, and a much faster design process. Further info is available from TRW RF Semiconductors, 14520 Aviation Blvd., Lawndale, California 90260.

73 for now!

*Bill Pasternak WA2HVK/6*
*14725 Titus St. #4*
*Panorama City CA 91402*

Suppose you are an area coordinating group faced with a growing list of requests for co-ordinated channel pairs on 2 meters from those wanting to put their systems into operation. You have a major problem since all available 30 kHz allocations between 146 MHz to 148 MHz are assigned and operating as well as having a number of simplex channels co-ordinated to active repeaters. Your list keeps growing but you have no place to put the newcomers. You realize that you must act soon if you don't want those waiting to go ahead on their own and "jump" an already assigned channel pair. You have but one alternative; open up and assign to those waiting the split-split 15 kHz separation channels.

On November 2, 1974, at their meeting in San Diego, this was but one of the pressing problems that faced the Southern California Repeater Association. They had to find and clear at least two 30 kHz channel pairs for amateurs in Mexico to use for wide coverage systems. They were being petitioned for recognition and voting privileges by user groups. There was that Deviation Standard to establish for 220 MHz now that the many assigned allocations were coming to life. And much more right in the middle of an amateur convention that had turned record attendance. How would you have liked to be chairperson for this one?

The problem of more repeaters than channels available has been a growing one for the past few months. Keep in mind that when SCRA started two years ago, they had more than enough repeaters to fill every channel between 146 MHz to 148 MHz and a couple of machines to spare. For example, WR6ABE, the most active repeater in Los Angeles with 500 plus member users in the Mount Wilson Repeater Association, operates on a non-standard allocation of 147.435 in – 146.40 out. (This due to technical problems caused by its location atop Mt. Wilson.) Two years ago most of us thought that the growth of two meter FM would peak by now and the present number of systems would suffice. Were we ever wrong. At the moment there is no one who will even venture a guess as to when the peak will be reached. Daily there are a number of new users on most of the systems I operate. The need for more repeaters in Southern California is a real one and providing space for them is of top priority. Faced with this, the SCRA voted to open the tertiary 15 kHz split-split channels for immediate occupancy.

However, unlike the Northeast some years ago, the SCRA has no intention of letting things get out of their control. A set of specific parameters will be followed in these allocations. First, before even approaching the SCRA for sanction and assignment, those proposing the new system must first obtain the consent of the repeaters operating 15 kHz above and below the channel pair they intend to occupy. Second, split-split channels will be assigned only in areas geographically suited to the particular system and the terrain will be used as shielding between areas. Put more simply, .205 – 805 for example will be assigned as many miles from .17 – .79 and .22 – .82 as possible with as many mountains between sites as possible. Third, all split-split assignments will be temporary and existing 30 kHz systems will be given the right to challenge the new tertiary system should interference between systems occur. The SCRA intends to keep a close eye on the operation of the split-split's and intends to do everything within their power to minimize any co-channel problems that the new assignments may cause.

Actually, to the other systems the problems occuring may well be minimal with respect to the many FM users in the Southland. If any problem occurs it will probably be to the user with the amateur type transceiver with its rather broad receiver. At the same time I had WA2ZWP New York on .205-.805 I owned an IC-2F, TR-22, HR-2 and an RCA CMCT-60 as various mobile and fixed stations. Without installation of super-narrow filters in the receivers and further

*Dick Flanagan W6OLD, SCRA chairperson leading a big meeting.*

*Many people besides the 46 repeater owners showed interest in this SCRA meeting.*

*. . .and they continued way into the evening.*

modification to the audio and squelch circuits for proper operation with the reduced receiver bandwith the IC-2F, TR-22 and HR-2 were all but useless on the system. The deviation peaks of both .19-.79 and .22-.82 played havoc with the three aforementioned radios even in the prime coverage area of ZWP. Aside from converted commercial Motorola, G.E. and RCA radios, the only thing that worked well out of the box was the Sonar 3601 with a receiver in it that was way ahead of anything else in its day in the selectivity department. (Some of the new equipment around today still does not come factory equipped as selectively sharp as the 3601, but one must remember that the 3601 was built right in the area where ZWP and other tertiary split machines were coming to pass. In fact, their factory was but three miles airline from our site, but whether that had anything to do with the receiver design I would not venture to say.) The majority of our users eventually replaced the wide filters with much narrower counterparts and solved the problem, but that created still another problem. Many of the radios had no frequency netting capacitors on the receive crystals and with the ultra narrow filters many crystals that were thought accurate were found to be a couple kHz high or low with no way to adjust them back on channel. It was either modify the equipment further to install netting capacitors or purchase High Accuracy – High Stability crystals and pay the price. For a while I felt I was supporting International single-handedly.

The synthesized Icom 230 radios face still another problem. They are

designed around a 30 kHz separation – 600 kHz split and operate that or simplex, that's it. Many of the 230's in and around L.A. have been modified for crystal control on the non-standard ABE system, but the proliferation of tertiarys, should this occur, will necessitate major modification to the synthesized frequency determining element of the transceiver. These are beautiful radios, but their purpose will be defeated if everytime a split-split channel is to be used a set of crystals has to be plugged in.

Will today's more selective receivers be adequate? Will all not only those wishing to use a split-split repeater, modify their radios? Remember that a split-split is only that in relation to the repeaters either side and it can cause the user receive problems on existing channels; your receiver's selectivity curve is the same on either channel. Even if you don't operate the split-split you may still need the new filter installed. Finally, how many of these systems will eventually come on the air and will this add to the overcrowding? To the latter I say yes, at least for the foreseeable future. As to the rest, only time will tell.

While on the topic of split-split systems, one of the most forward looking proposals to date has been brought forth by the Mt. Wilson Repeater Association. As proposed by Bob Thornberg WB6JPI, its President, and Russ Soloman WA6DUC, the official spokesperson for MWRA, it would invert the split-split allocations; ie: high in – low out between 146 to 147 MHz and low in – high out between 147 to 148 MHz. Eventually, after all allocations were filled, you would wind up with alternate repeater inputs and outputs every 15 kHz. Here is the logic to the idea. It is far easier to keep one signal on a given channel from interfering with its neighbors 15 kHz either side than it is to keep a couple hundred mobiles on channel and deviating properly. A 10 W mobile near a repeater output frequency will cause a lot less havoc than two repeaters will to each other. Also it is then only the individual repeater that will have to "filter" for an ultra-selective receiver since most of the time the users receiver will be seeing a 30 kHz slot. There might be some problem if two mobiles are operating on adjacent channels within close proximity of one another, but that shouldn't happen too often. Couple this with proper geographic spacing and use of terrain for shielding and it could make for a viable split-split system. At least it's worth both consideration and experimentation. In fact, one of the new split-split systems has announced its intention to try just that. The SCRA had adopted the "standard ARRL plan" that does not invert the splits.

This proposal submitted to the SCRA Technical Committee for evaluation is based on solid evidence of its viability. The input to the WR6ABE repeater is 147.435, technically a split-split channel. About a year ago, another machine, WR6AAB came on the air with its 147.500 output. Initially, some interference did exist, but Burt Weiner K6OQK, owner of WR6ABE, and Dave Corsiglia WA6TWF, owner of WR6AAB, were able to solve the problem in short order and without effecting the users of the two systems. It was solved by working with two people and two repeaters, not a couple hundred mobiles. Even though the two repeaters were on respective mountains line-of-sight to one another, there was but one transmitter and one receiver to contend with.

Now, while this proposal does not solve the split-split problem for the IC 230 owner, and in fact somewhat complicates it for him, it has the potential to solve it for the rest of us. If you are interested in receiving a two page copy of this proposal, or wish to comment on it, you can send a SASE to the Mt. Wilson Repeater Association, P.O. Box 10193, Glendale, California 91209. I too am interested in your comments.

A lot more transpired at this SCRA meeting, but to the rest of the country, the decision to activate the tertiary channels holds the most significance. Next month we will continue with this report and if any of the split-split's get on the air by that time we will let you know how things are going.

**de WA2HVK/6**

*Joe Kasser G3ZCZ*
*1701 East West Highway, Apt. 205*
*Silver Spring MD 20910*

In this month's column I'd like to pass on some details about operations in Japan, as presented by JA8MWO. There is no reciprocal operating agreement between Japan and other countries. That means that foreigners can not get operator licences. However they can get permits to operate club stations. If you are going to Japan the people to contact are the Tokyo International Amateur Radio Association (TIARA) at 22-5 Oyama-Cho, Shibuya-Ku, Tokyo 151. If you are already in Japan, call 466-6003 in Tokyo.

The frequencies available for use in Japan are different to those in use in the USA. On top band they can only use 1907.5 to 1912.5 kHz CW, on 80m they are allowed 3.5 to 3.525 kHz CW and 3.525 to 3.575 kHz phone. On 40m they have 7.0 to 7.03 kHz CW and 7.03 to 7.1 kHz phone.

On two meters FM is very big on simplex, repeaters not being legal. The main frequencies in use being 144.48 for calling and 144.36 for inter-island DX chasing. Their FM channels have 40 kHz spacing.

Yaesu is advertising a new rig in Japan and in Europe. It is called the FT-220 and is a two meter rig not a 220 rig. It covers 2 MHz of the band with SSB and CW. It even has 600 kHz spacing for repeater use. It costs about $400 and seems to be ideal for both local working and OSCAR use. When are they going to import it to the USA?

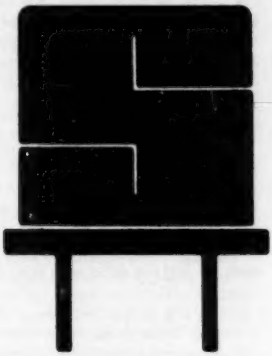
Turning from Japan to Europe, I'd like to update your list of two meter repeaters. Each of the ten channels is coded as follows:

| CH. NR | INPUT | OUTPUT |
|---|---|---|
| R0 | 145.000 | 145.600 |
| R1 | 145.025 | 145.625 |
| R2 | 145.050 | 145.650 |
| R3 | 145.075 | 145.675 |
| R4 | 145.100 | 145.700 |
| R5 | 145.125 | 145.725 |
| R6 | 145.150 | 145.750 |
| R7 | 145.175 | 145.775 |
| R8 | 145.200 | 145.800 |
| R9 | 145.225 | 145.825 |

The repeaters are located as follows:

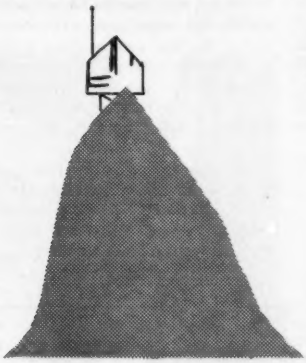
| | | | |
|---|---|---|---|
| **ENGLAND** | | | |
| Cambridge | R6 | | |
| London | R7 | | |
| **ISRAEL** | | | |
| Jerusalem | R7 | | |
| **SWEDEN** | | | |
| Bollnas | R2 | Boras | R8 |
| Gellivare | R2 | Goteborg | R2 |
| Huskvarna | R6 | Kalmar | R8 |
| Kiruna | R8 | Malmo | R7 |
| Nassjo | R2 | Skelleftea | R4 |
| Stockholm-2 | R5 | Stockholm-3 | R8 |
| Umea | R8 | Uppsala | R6 |
| Falun | R8 | Helsingborg | R2 |
| Karlskrona | R6 | Mellerud | R4 |
| Stockholm-1 | R2 | Sundsvall | R8 |
| Ystad | R8 | | |
| **DENMARK** | | | |
| Aalborg | R2 | Bornholm | R2 |
| Kobenhavn | R6 | Lysnet | R6 |
| Esbjerg | R2 | Ringsted | R2 |

Do you know that on the 18th of August 1973 all amateur radio activity in the country of Afghanistan was ended by their government. That means that YA calls are no longer



## REPEATER OWNERS

Don't Take Chances. SENTRY offers custom made crystals made exactly to your specifications. When it comes to crystals for your repeater, BUY THE BEST – SENTRY.



## REPEATER USERS

If you want reliable access to the repeaters in your area, you want and need SENTRY CRYSTALS. SENTRY CRYSTALS are custom made for your rig. We don't stock a large quantity of crystals for a certain frequency and hope you can tweak them to frequency in your rig. We do offer FAST service on crystals made especially for you and your rig. If you want reliable, on-frequency operation, INSIST ON SENTRY.

**SENTRY MANUFACTURING COMPANY**
**Crystal Park, Chickasha, Oklahoma 73018**

**PHONE: (405) 224-6780**
**TWX-910-830-6425**

heard on the air. Little seems to have been published about this happening in the amateur radio press, and with a frequency allocations conference coming up in the near future, one would think that someone would have raised a shout or two. Singapore lost the two meter band, France has put military stations in the two meter band, boy we are loosing our VHF frequencies slowly while the ham world looks forward to gaining new HF frequencies. Is that our future, only HF operations and no VHF activity? This possible future makes our use of VHF and UHF imperative at the present time, particularly with the OSCAR spacecraft. By the time that this appears in print there should be two amateur built spacecraft in orbit, both useable as communication relays.

Does anybody have any QSL bureau lables that they don't want? These are the labels that are affixed to QSL cards when they pass through the outgoing bureaux overseas. I'm putting together an exhibit of amateur radio in postage stamps and labels and could use some more labels. Talking of philately, first day covers of the launch of AMSAT-OSCAR 7 are still available from Amsat, Box 27, Washington DC 20044 for $1 and an SASE (business size #10).

...G3ZCZ

*Schley Cox WN9LHO*
*219 Kilgore Avenue*
*Muncie IN 47305*

Contest operating is a lot like the "good for what ails you" snake oil elixir once sold by the traveling medicine show hucksters. . .it may not hurt you and it even may do you some good.

Any contest involving some CW activity — and that's most of them — will have some activity on the low end of the Novice bands. There are also some contests designed for Novice operators, taking place only in the Novice bands.

You say you're not interested in contests? Well, they may not hurt you. Working a contest improves operating skill. The extremely abbreviated contest message exchange could give a rag chewer the idea to get out that list of CW abbreviations and see if the length of his transmissions could be cut without cutting the content.

The fast break-in type exchanges might promote a more conversational like exchange on the CW bands instead of the rather stilted, rigid exchanges we now suffer.

Want to add some to your code speed? During contests I'm always amazed that the weights on my bug seem to get pushed up to the machine gun chatter position, and even more amazed that the ops on the other end seem to copy it solid with very few repeats.

Here are a few general contest operating hints. First, be modest. If you do your best and should happen to win something in the contest, shuffle your feet, smile a little, and say, "Aw shucks."

After you get your attitude in shape, make sure your equipment is ready. The antenna work should be done in the warm months. Roofs and poles are bad enough without a covering of ice. A lot of contest operators spend part of their summers carefully tuning the new antenna knowing that the big test won't come until the ice storms do. But your antenna should be designed so that you can get to the connections (or get them to you) and check them in nearly any kind of weather. Check ropes, pulleys and guys too.

The time to find a cold solder joint in the rig is before the contest, not during. Inspect your rig for loose connections and tubes and plug-in devices. Treat yourself to a few spare tubes if you can afford them. Saturday night is not the time to try and find a 6146B amplifier tube.

If you don't have earphones, get some good ones before the contest. Many of the conventional navy-type phones, even with rubber pads, get very uncomfortable after 24 hours of operating. Consider the stereo listener's type if you can match the impedance between the phones and your receiver.

If you have a TVI problem then quiet hours won't help you much during a contest. You need to take advantage of 15m whether there's a big Saturday game on or not. Consider the use of a tuner, a TVI filter, or better shielding to keep peace in the world.

Get some rest before the contest. You'll need it. Many of them run for 24 hours out of a possible 30. That leaves a little time for a nap, church and a few pit stops. Cajole somebody into bringing you food in your shack during the contest. Promise to take the trash out for a week.

The major contests are listed in advance in the radio magazines. Check and see if there is any Novice activity planned, send for the log sheets and any special operating aids that might go with the contest. Remember to read the current rules very carefully. Contest rules change from year to year so don't look them up in an old back issue. Follow the rules to the letter.

Keep a copy of the contest log with your regular log. Most contests generate some QSL activity. During a recent contest I worked 48 states, including KH6, KL7, Delaware and Wyoming.

Like the man said, "It may even do you some good."

# QSL CONTEST

Arnold Goldman, our winner this month, has used a photo of his lovely YL assistant op "chewing the rug". Arnold wins a free year's subscription to 73. Keep sending your cards. You could be a winner. Mail to 73, QSL Contest, Peterborough, NH 03458.

# AMSAT NEWS

Michael Frye WB8LBP
1640 Deanville Dr.
Dayton OH 45430

## OSCAR 7 UP

Once OSCAR 7 is in orbit and the onboard batteries have had time to charge (about two days), the operating schedule below is expected to be the one OSCAR 7 will use.

Sun., Tues., Fri. . . .two-ten meter repeater on: uplink – 145.85-145.95; downlink – 29.4-29.5; beacon – 29.5.

Mon., Thurs., Sat. . . .432-145 MHz repeater on: uplink – 432.125-432.175; downlink – 145.925-145.975; beacon – 145.98.

Wed. . . .Recharge mode, special use by arrangement only.

## OSCAR 7 FIRST DAY COVER

Amsat has made arrangements for 2000 first day covers to be made available for amateurs interested in stamp collecting – and these should turn out to be real collector's items. The first thousand will have the hideous purple amateur radio stamp on them, the second thousand will use the Progress in Electronics stamp. Send $1 or five IRC's for the cover, plus a SASE #10 envelope for return. . .or one extra IRC if no postage for the return. Send to Amsat, Box 27, Washington DC 20002.

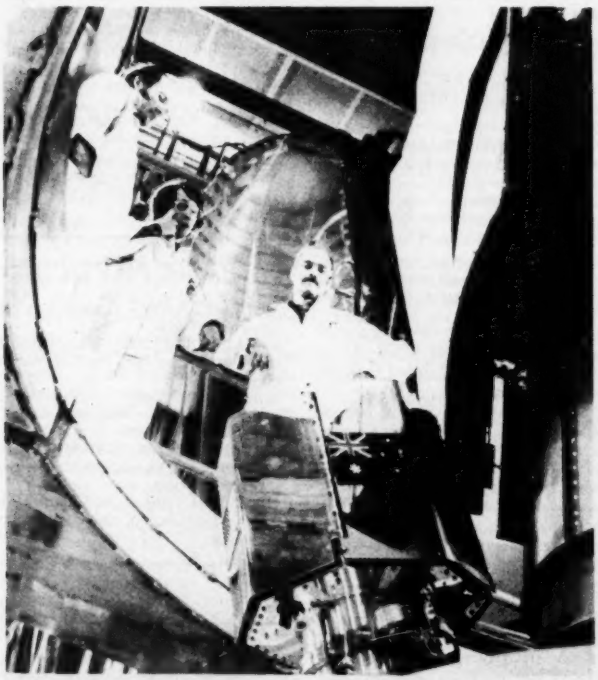
## JOIN AMSAT

The Radio Amateur Satellite Corporation (AMSAT) is a non-profit, tax-exempt organization founded in the greater Washington, D.C. area five years ago. It is a membership organization open to all radio amateurs and interested non-amateurs. AMSAT's satellite programs are supported entirely from donations, membership dues, and grants.

Join AMSAT. Learn more about how you can participate with the exciting AMSAT OSCAR 6 communications satellite, and with OSCAR 7 which promises to be even better. Receive the quarterly AMSAT Newsletter with the latest information on this new ham radio frontier. For membership information, write the Membership Committee, AMSAT, P.O. Box 27, Washington, D.C. 20044.

*W6OAL, K3JTE and WA4DGU in front of the Delta vehicle gantry at the NASA western test range, Lompoc, Ca.*

*Marie Marr (AMSAT aerospace technician) and Jan King W3GEY A-O-B project manager prepare AMSAT-OSCAR B for solar simulation test.*



*OSCAR 7 as it sits on the Delta 104 Rocket beneath the ITOS-G weather satellite.*

## OSCAR 6

**Orbital Information**

| Orbit | Date (Jan) | Time (GMT | Longitude of Eq. Crossing °W |
|---|---|---|---|
| 10110 | 1 | 0104.6 | 64.6 |
| 10122 | 2 | 0004.5 | 49.6 |
| 10135 | 3 | 0059.5 | 63.3 |
| 10148 | 4 | 0154.4 | 77.0 |
| 10160 | 5 | 0054.3 | 62.0 |
| 10173 | 6 | 0149.3 | 75.7 |
| 10185 | 7 | 0049.2 | 60.7 |
| 10198 | 8 | 0144.1 | 74.5 |
| 10210 | 9 | 0044.1 | 59.4 |
| 10223 | 10 | 0139.0 | 73.2 |
| 10235 | 11 | 0038.9 | 58.2 |
| 10248 | 12 | 0133.9 | 71.9 |
| 10260 | 13 | 0033.8 | 56.9 |
| 10273 | 14 | 0128.7 | 70.6 |
| 10285 | 15 | 0028.7 | 55.6 |
| 10298 | 16 | 0123.6 | 69.3 |
| 10310 | 17 | 0023.5 | 54.3 |
| 10323 | 18 | 0118.4 | 68.0 |
| 10335 | 19 | 0018.4 | 53.0 |
| 10348 | 20 | 0113.3 | 66.8 |
| 10360 | 21 | 0013.2 | 51.7 |
| 10373 | 22 | 0108.2 | 65.5 |
| 10385 | 23 | 0008.1 | 50.5 |
| 10398 | 24 | 0103.0 | 64.2 |
| 10410 | 25 | 0003.0 | 49.2 |
| 10423 | 26 | 0057.9 | 62.9 |
| 10436 | 27 | 0152.8 | 76.6 |
| 10448 | 28 | 0052.8 | 61.6 |
| 10461 | 29 | 0147.7 | 75.4 |
| 10473 | 30 | 0047.6 | 60.3 |
| 10486 | 31 | 0142.6 | 74.1 |

# 50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

From Ray K5ZMS/5, "If you want to see Heath put another 6 meter SSB transceiver on the market, you had better heed what Mr. J.E. Shafer K8DCE, Communications Product Manager of Heath, says. In a letter to me recently he stated that customer correspondence is their best aid in planning new products! Get the hint? He said also that they have been considering a new 6 meter SSB transceiver, but as yet no decision has been arrived at. So, get on the ball and help them make a positive decision for 6 meters. Drop them one of your QSLs and tell them that you want to see such a product of theirs back on the market. Write to Mr. J.E. Shafer, Communications Products Mgr., Heath Company, Benton Harbor, Michigan 49022." I note in the most recent Heath catalog an Electronic Engineers Wanted column requesting applications for, among other things, "Communications Products Design Engineer – BSEE with 2-5 years in solid state circuits, SSB and FM modes, VHF and digital logic." A little reading between the lines yields a very pleasing possibility.

Harold WØLFH writes from Algona, Iowa to say he has picked up a pair of E.F. Johnson 30 W, 48 MHz AM transceivers and plans to modify them for 6 meters. Anyone active on 6 AM might want to drop Harold a line at 602 W. Nebraska and let him know about the local activity and perhaps set up a schedule with him.

WB4OSN told me during an opening last Sunday that October had been very poor in Florida. The only DX was a midmonth contact with TI2NA. Bob W4GDS confirmed the situation. The following evening the band was open here to Mexico, Utah, Arizona, Nevada and California. Tuesday evening (10/29) W7VDZ was in running 5-8 with absolutely no evidence of any other activity on the band.

George WA1PDY and his friend John WA1SCG set up a portable station on a lookout tower in the center of Cape Cod the first weekend in August. They ran an HA-460 from a car battery and fed the 8 W into a pair of 3 element Hilltoppers. The beams were about 35 feet off the ground at the highest point on the Cape (250 feet). The longest distance covered was to Sioux City, Iowa... over a thousand miles. Other states worked included Ohio, Michigan, Wisconsin, Tennessee, and Indiana. They never received less than a 5-8 report...not bad for the power level in use. George takes pleasure in pointing out that it doesn't take fancy or expensive equipment to have fun working skip, his expenditure for the HA-460 was all of $40.

Several weeks ago I received a letter from a company in northern Illinois stating they were specializing in 6 meter gear and reciting all of the items in stock. Included in this list was the Yaesu FT-620B. I immediately wrote the gentlemen and inquired about this particular item...I am still waiting on the reply. It just so happened that in the same mail I had received a letter from Fred DEEG K6AEH, Marketing Manager for Yaesu, stating that the situation with the FT-620B had remained status quo since my initial inquiry early last spring, April as I remember. At that time Fred had told me that there was but one prototype in the country and that the plans for importation were still very much unsettled with plans (at that time) to introduce it to the American market in the Fall. While there may be a few in the country brought back by individuals, general distribution plans are not set at this time. You will read it here as soon as they become available.

I understand W1HDQ is back at the helm with Bill Smith running for director...(if you can't say anything nice, don't say anything)...WAØABI

# HAM HELP

This column is for those needing help in obtaining their amateur radio license.

If you are interested, send *73* your name, address and phone number. Don't be bashful – remember, it's always easier when you have someone to give you that added bit of confidence.

*73* would appreciate amateurs and clubs looking this list over and helping whoever they can. Do you remember when you needed help?

Al Bauer
141 Hawthorne Ave. 306
Central Islip NY 11722

Lennie Fekula
Rd 1
Hickery PA 15340
Telephone 412-356-7316

J. E. Keezer
25 E Elm St. Box 395
Central Islip NY 11722

K. Baker
11 Scotch Pine Drive
Central Islip NY 11722

John Stringos, Jr.
732 Princeton Blvd.
Lowell MA 01851

Mrs. Shirley Johnson
46 East Tamarack St.
Central Islip NY 11722

Basil W. Polinchak Sr.
SV Sta Box 81
Andover MA 01810

Tim Johnson
3965 Geist Road – Apt. E5
Fairbanks, Alaska 99701

Mr. James H. Pruitt
R. R. #4
Zelma MO 63787

Mr. and Mrs. Royce Carl
5806 114th N.E.
Kirkland WA 98033

E. Karl
63 Cranberry St.
Central Islip NY 11722

Amateur Radio License Classes are being started. Instructors needed. All who are interested young, old, male, female, write Amateur Classes SV Sta, Box 81, Andover MA 01810 or call 685-3910.

## BASIC PHYSICS

MURPHY'S LAW – If something can go wrong, it will.
PARKINSON'S LAW – Work expands so as to fill the time available for its completion.
WELLER'S LAW – Nothing is impossible for the man who doesn't have to do it himself.
FINAGLE'S LAW – Once a job is fouled up, anything done to improve it makes it worse.
McGURK'S LAW – Any improbable event which would create maximum confusion if it did occur...will occur.

### CRYPTOGRAM

*WPBQBCQW RUT PYJJ FKXQ VU WYDFEL TVJQLL RUT SYDFE SUW EFQB KVA LEYZH TI EFQB. – VLA.*

*Remember, you will have no rights unless you fight for them and stick up for them.*

Bill Turner WAØABI
Associate 73

The latest issue of "THIS MONTH", a flyer published by Herbach & Rademan, 401 East Erie Avenue, Philadelphia, Pa., 19134, has a number of items of interest for any confirmed scrounge. I would imagine the 10½ inch reels of ¼ inch recording tape won't last long if automatic repeaters become a reality. These have the standard hub, not the NAB type and are full of 1 mil polyester low noise tape and are stated as having been used once or twice. The reels are fiberglas and should last forever. This is a bargain for the reels alone, as is each reel will record 12 hours at 15/16 ips or twice as long if the tape is replaced with .5 mil Mylar. If a multitrack head is used the time becomes fantastic. Putting these to use isn't as complicated as it might at first seem. The takeup and supply motors of any three motor tape deck are easily repositioned to accomodate the larger reels, other decks can be modified by the addition of two phonograph motors and a little hub fabrication. The price is $3 each or 10 for $20. The minimum order is $7.50.

Another goodie from the same source. . .a clock motor with outputs at 1 RPH, 1 RP12H and 1 RP24H to make a combination local and Zulu clock. With hardware and cord, less hands and face, made by Ingraham, $3.50.

Poly Paks is advertising the PCB for a 12 digit calculator, a first to my knowledge. Everyone who has been putting off building one may now have at it with reasonable assurance of success. Also available are the keyboard, the chip and DIP resistor networks to match. The chip is the popular Cal-Tech CT-5001 with decimal switchable to 0,2,3, or 4 places, leading zero blanking, overflow, negative sign and chain capability. The PCB is $3.95, keyboard $6.95, resistor networks $1 each: (two required) and the chip is $5.99. A wide range of LED alphanumerics are available too. These run from .1 inch magnified to .7 inch direct view. Naturally red, green and yellow are available.

To disgress for a moment, the author has had occasion to work with some orange discrete and seven segments of late. These are not on the market as yet but it won't be long. Another innovation on the way is a discrete with the die mounted in the center of a reflector. The result is a much brighter LED with the appearance of a bright spot with an equally bright halo. . .most impressive.

Electronic Distributors, Inc., 4900 N. Elston Ave., Chicago, 60630, has several items too. How about some horizontal mount PC coil forms at 29 cents each or four for $1? These are 7/32" diamater by 11/16" long, come equipped with four terminals and a ferrite slug. For those devoted to plug-in coils there are 5/8" diamater by 1¼" forms with the mating socket for 29 cents or 4 for $1. The forms alone are 19 cents or 4 for 60 cents.

Could you use a brand new UHF TV tuner for $3.95? These are similar to the units used in the FM and Repeater Handbook 420 converter.

Need cheap components? How about resistors preformed for PC boards for ½ cent each? (200 for $1). These are assorted and of the several packages received there were perhaps 30 values, these were all popular values by the way, nothing way out. The quality is as good as you can buy, many were 5%.

Need some line cords. . .good ones. . .6 feet long, the same source has them for 20 cents each (5 for $1). Assorted slide switches at 10 for $1. 250 solder lugs, 20 resistors, 5-10-20 W types, 500 assorted rivets? All of these items are available from Brooks Radio & TV, 487 Columbus Avenue, New York 10024. The minimum order there is $5.

Digi-Key Corporation, P.O. Box 126, Thief River Falls, Mn. 56701, has MPF102's for 44 cents each or 10 for $3.80. . .a bargain on a very useful and universal item. Another goodie. . .1 MFd to 100 MFd electrolytics run 14 to 19 cents each in single lots dropping to 12 to 15 cents in lots of 10.

Need a dual 5 amp power supply? One is fixed at 12 V, the other is variable from 0 to 42 V. Everything is included except the case and metering. Transformer, 2 bridge rectifiers and filter capacitors switch, line cord, pilot light. . .all the pieces for $22.50 from Delta Electronics Co., Box 1, Lynn, Mass. 01903.

**WAØABI**

# PAST GOOFS

### W5LCT CORRECTION

I wes greatly impressed with ingenuity that Earl C. Dunn, Jr. W5LCT used in deriving his selective call system as appeared in 73 Magazine October 1974, Page 51. I was so impressed with the simplicity of it that I am going to incorporate it into a decoding system that I am building now.

In studying the drawings, I found an error on page 54, Fig. 3. Pin 3 of the 7402 should be connected to pin 12 of the same IC. Without this connection the circuit will not activate the relay.

I have drawn many logic circuits and have found errors of this type very easy to make while copying a circuit for a friend.

I read 73 Magazine from cover to cover and enjoy every word. Thanks and keep those logic circuits, as well as others, coming.

**N. Blahos**
**WA3IUQ/NØRON**

### W2OC CORRECTION

High-Low Frequency Monitor, Fig. 1, page 110, Nov. 74 issue of 73 Magazine.

R8, 6.8 K resistor should be 4.7 K and bottom end in schematic should connect to +5 V, *not* ground.

### JULY 74 CORRECTION

There is a misprint on page 72, Fig. 4.

It should read:
Note: Run Neutral of 220V to transformer's *only* if operating two 110V unbalanced primaries in series. *Do not fuse common line.*

**Ed Hartz K8VIR**

# SSTV SCENE

*Dave Ingram K4TWJ*
*Rte 11, Box 499 Eastwood Vil. 604 N.*
*Birmingham AL 35210*

Welcome to 1975 – the 50th Centennial Year of Television. As you may have heard, either on the air or from previous SSTV Scene columns, I am planning a re-activation of 1925 style television as a nostalgic interest project. These TV signals bear a resemblance to the early amplitude modulated subcarrier used in Slow Scan TV, but receiving apparatus is much simpler. Watch for more details on this as the year progresses.

Inflation is a major subject this year with soaring prices on everything imaginable. Food is so expensive that it's cheaper to eat money and even commercial ham equipment has crunched the kilobuck range. I seriously believe the only item to drop in price this year will be the MOS shift register. Bulk production of these chips, and many popular ICs, may place items like the SSTV Keyboard, the Fast to Slow Scan converter and Slow Scan's outstanding item for 1975, the Slow to Fast Scan converter within comfortable reach of all home brewers. Printed circuit boards for these items are now available thus assuring success to even the inexperienced amateur. Placing components in the proper board holes is quite simple and if each capacitor, resistor, transistor, etc., is checked briefly before installation, success is obvious. The main PC board designers at this time are WØLMD and W6MXV.

Possibly 1975 will be the year Slow Scan will prove itself during unfortunate emergencies.

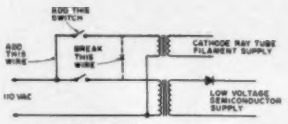
Watch for one or two new companies to enter the Slow Scan field, one possibly using an electrostatically deflected unit.

As usual, the Dayton Convention this April should prove a gold mine of knowledge, so plan now to attend.

I think we may get Wayne Green active again on Slow Scan – showing ideas and making faces. FM may be fun but Slow Scan is sensational.

### W6MXV Scan Converter Announced

Mike Tallant W6MXV recently sent us a package of information on his new Fast to Slow Scan converter which has some outstanding features. This unit connects to any regular Fast Scan camera and outputs directly with Slow Scan TV. Absolutely no modifications to the camera are required. The unit boasts black to white inversion capabilities, partial frame scans, built in gray scale generator and more. The converter may be powered from 110 or 220 V mains, and 50 or 60 Hz operation is selected by one jumper

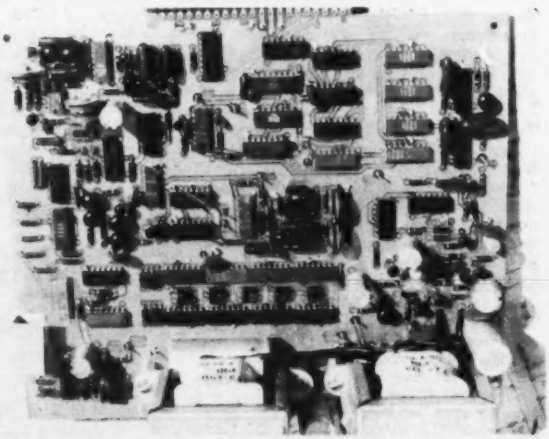



on the PC board. His demonstration tape revealed very good quality pictures which swung nicely from absolute black to peak white. I also noticed the five step gray scale calibration display could be switched to mix with any picture. Mike is producing PC boards and kits of this unit and, like his monitor, they are top quality.

The glass boards, complete with gold plated connector strip, are 35 dollars. A complete kit of parts less cabinet, knobs and power cord is 175 dollars. Wired and tested boards are also available for 235 dollars. Future plans include a complete camera with sampling adapter, through viewfinder and F lens at a competitive price.

### Help A Transistor

Here's a helpful suggestion for those of you with solid state monitors, either commercial or home brew. Try connecting the cathode ray tube filament transformer so it may be switched independent of the solid state circuitry, like in Fig. 1. This "standby" and "operate" modification gives "instant on" capabilities plus relieving any unnecessary strain on deflection transistors. Many Slow Scan monitors do not produce a raster when they are on and not receiving an SSTV signal. This means the cathode ray tube's electron beam is deflected to the edge of the screen. When this



*The W6MXV scan converter board.*

happens, two deflection transistors are cut off and the other two are conducting heavily. Naturally this condition doesn't boost transistor life. My simple modification eliminates this possible problem.

**Ramblings**

This month's pictures were snapped off the monitor by Gene W1VRK. The pictures of his son and daughter examplify the high resolution obtained on Slow Scan TV (and Gene's superb photography).

The Slow Scan contest is happening again next month, so plan to join in the action. Full details will appear in next month's column.

**...K4TWJ**

get busy at the local ham club and the boy scouts, set up code and license classes, bring in new hams. Recruit!

**Wally Thompson WB5IUL**

**LDEs**

I read with great interest the item on page 12 of the November 73 on "Long Delayed Echoes." This little understood phenomena has been my field of research for several years. Using a General Electric P-7 self cleaning transmitter on 5 million meters, I too have heard echos.

Signals are initiated by sending the code sequence BS at 60 wpm. The time period of the echoes can be predicted from the formula $T=3.14159\frac{APQ^2}{D5}$ where T=time in seconds, A=angle of radiation in Hours of Right Ascension, P=pulse rate in Bauds/Fortnight, Q=the density in quasars per cubic parsec, and D=the distance in light years.

Using the graphical solution as suggested by Lunan, but substituting semi-logarithmic circum-polar coordinates, the results always appear to resemble the constellation of Taurus.

By the way, the Mono-Reproducer was incorporated in the receiving setup, and provided the necessary gain to receive the weak echo returns. Thanks for the fine construction articles. Who said all hams are appliance operators?

**Henry Testa K8MUF**

# LETTERS

ou goons don't ever proofr
lousy
bunch of rocks
you ignored my
I insist that you print ev

**DESTROY ALL CLUES**

Right now you have in your files hundreds or thousands of letters on your courageous stand against the IRS. Before they get any smart ideas and suppoena those letters to use against the letter writers, why don't you cut off any clues to their origin such as name and address? A comment to that effect in your wonderful editorial would have many hams sleeping easier at night. Big brother is still watching.

**Clive Frazier K9FWF/4**

*All names are clipped off letters with IRS info to protect the writers so there is no problem. I have a whole file cabinet now devoted to cases of IRS harrassment reports — and clippings or letters with more will be appreciated as this is developing into a fantastic book. I note that the IRS chief now says he wants to stop persecuting Mafia — presumably to free agents to do jobs on citizens less able to fight back using the same police state tactics granted to IRS to get the Mafia...ed.*

**RECRUIT RECRUIT RECRUIT**

I enjoyed WA1GFJ's "Buy Buy Buy" article in the October 73 because it states the kind of truth we hate to admit and rarely sees in print. May I suggest however there is a corollary which Gabe omitted — and that is: Recruit Recruit Recruit! Stop and think, most of you bought rigs when you were new in ham radio. So

**FAN MAIL**

Your present editorials are mostly dull and without life. I remember them from years back where you gave everything and everybody hell.

**Kurt Bittman WB2YVY**

**NATIONAL CONVENTION**

Please advise the writer of "Convention Critique" on page 3 and 4 of the October 74 issue of 73 Magazine that we appreciate his comments very much. Further advise him the 1976 National ARRL Convention is being held in Denver, Colorado at the Hilton Hotel. His challenge to "Philly" to do better is unnecessary. The ARRL has officially picked Denver for the '76 convention.

**B.R. "Slats" Council KØATZ**
**General Chairman**
**1976 National ARRL Convention**

**THE VALUE OF X IS...**

Why is the X skipped over in all call areas when calls are assigned? Why doesn't W3XAA follow W3WZZ instead of W3YAA?

**Ronald Fields WN3WEE**

*X is for experimental stations only... wayne.*

**EXPLAIN, PLEASE**

I have noted your attempts to improve the best ham radio magazine presently published in the U.S.A. I read your requests for contributions from your readers with some frustration; I am a priest first, a ham radio operator second!

Like many other of your readers (I suspect they are legion) I too like to build and to experiment with the new electronic wonders that are being offered in the pages of your great magazine. One of the problems for many of us in ham radio who are not actively engaged in the field of electronics professionally is that we don't know what all those little bargain gadgets are! Today, I was rereading the November, 1974 issue of 73 Magazine; you'd be surprised, Wayne, at the things one can learn by just reading, rereading and reading again the pages of any given issue of 73! On page 40 I found that article by W2AOO about impressing your friends with a digital wind direction indicator.

I was much impressed (never mind my friends)! I was all set to try it, then I realized I didn't know what a SN7404, SN7442 or even an LM309K are! I did find what appeared to be corresponding numbers listed in the ads in the back of 73.

That's the whole trouble in a nut shell, Wayne! I don't really need a wind direction indicator to impress anybody; what I do need is someone to tell me what all those "goodies" are that are being advertized at such bargain prices in the back of the 73 Magazine! If there are other readers in the same state of the art as I, then there should be a great potential for an article on just what all those goodies are and what one can do with them. Can you imagine all the sales that would accrue to your back page advertizers as a result of it?

Thanks, Wayne, for reading one more suggestion, and especial thanks for doing something about it!

**Fr. R.O. Gardiner W6LZJ**
**Long Beach, California**

*OK, Father. Good suggestion. We'll try to get some info on this...wayne.*

# NEW PRODUCTS

### WAHL QUICK CHARGE IRON

Wahl has added a third iron to their line, one with fast charging Nicads which will charge in about one third the normal time! An hour or two will bring a weak iron up to strength and four hours will bring it up to capacity from fully discharged. Wahl Clipper, 2902 Locust, Sterling IL 61081.

### CANADIAN HAM REGS

The Canadian Amateur Radio Federation has out a completely new edition of their Radio Regulations Handbook. This book has the regulations and guidelines for all types of amateur operation including RTTY, TV, remote control, fax, repeaters, etc. Send for your copy, $4, to CARF, Box 356, Kingston Ontario K7L 4W2, Canada.

## 450 MOBILE ANTENNA

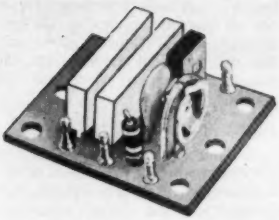
Antenna Specialists has a new one for 450 – wideband tuned for repeater use and capable of handling 150 Watts. The ASP-830 has a pair of 5/8 wave elements in a vertical colinear design for a gain of 5 dB. Antenna Specialists, 12435 Euclid, Cleveland OH 44106.

## 160 RISES AGAIN!

One of the big movements in recent months has been the resurgence of interest in 160 meters – and one company in particular has been making this easy for amateurs: Dentron Radio, North Olmstead, Ohio. The Denton 160 Meter Transverter works with any 80 m transceiver, SSB, AM, or CW, with 100 watts input to the final 6146 tube. It will work with as little as 5 watts drive. The 160XV is very simple to use, requiring only two connections to your existing station. The unit sells for $199.50.

Dentron also has an antenna tuner available which will help you load up just about anything and get a good signal out. The 160AT tuner sells for $49.50. Some ops are loading up their tower, their 80m antennas, and even window screens with this tuner. For further info write to Dentron, 27587 Edgepark Drive, North Olmstead OH 44070.

With this setup you can find out for yourself why so many old time ops think that 160m is one of the best phone bands we've ever had.



## TINY TONE ENCODER

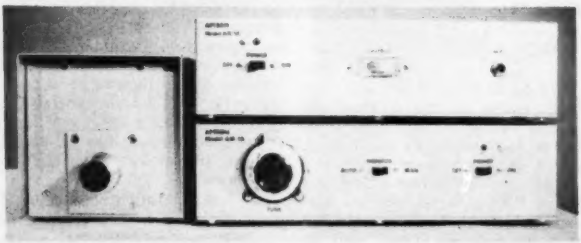
The fellows at Alpha have been at it again with their miniature shoehorn, cramming all sorts of nice things into almost nothing. This oscillator will run from 20-3000 Hz, is set on frequency by a laser trimmed module and draws about 4 mA at 12 V. Note this one unit will go from subaudible to tone burst frequencies. Alpha Electronic Services, 8431 Monroe, Stanton CA 90680.

## MIDLAND RSVP PROGRAM

Midland has announced a plan for contributing $10 to the repeater group of your choice when you buy a Midland 2m rig. You get an RSVP card along with the 13-500 (15 Watt 12 channel) or the 13-505 (30 Watt 12 channel) rigs ($250 and $300 respectively). The card is returned to Midland when a rig is purchased and they send a check to the repeater you designate.

## HAM TV EQUIPMENT

Aptron, of Bloomington, Indiana, has introduced a complete line of ham television (fast scan) equipment. This includes a Vidicon camera of broadcast performance, a 10 W aural/video transmitter, and a converter for using your home television set for monitoring and receiving. . .all solid state.



# Caveat Emptor?

**PRICE** – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order. Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.
Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.
We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.
For $1 extra we can maintain a reply box for you.
We cannot check into each advertiser, so Caveat Emptor . . .

**TECH MANUALS** for Government surplus gear – $6.50 each: R-274/FRR, R-220/URR, URM-25D, CV-591A/URR, CV-278/GR, TRM-1, TS-382D/U, TS-497B/URR, TT-63A/FGC, URM-32. W3IHD, 7218 Roanne Drive, Washington, DC 20021.

**CALCULATOR OWNERS:** Use your +-x÷ calculator to compute square roots, cube roots, trigonometric functions, logarithms, exponentials, and more! Quickly, accurately, easily! Send today for the IMPROVED AND EXPANDED EDITION of the First and best calculator manual – now in use throughout the world. . .still only $2.00 postpaid with unconditional money back guarantee! Mallmann Optics and Electronics, Dept. -E7, 836 South 113, West Allis, Wisconsin 53214.

**JIG SAW PUZZLES** wanted. If you have any old wooden jig saw puzzles in your attic – or run across them at an auction (they go for 25¢ usually), please keep in mind that Wayne Green collects them and might even pay a buck apiece for them. c/o 73 Magazine, Peterborough NH 03458. Wood, not cardboard – and complete.

**CALL LETTER LICENSE PLATES** – still being collected by 73 Magazine for possible cover use. Please send in an old call letter plate – most treasured are out-of-district plates such as W2NSD/NH, etc. Got any real oldies? 73 Magazine, Peterborough NH 03458.

**COLLECTOR** is interested in books, autographs and other information on early radiotelephone pioneers. Ronald Phillips, 1925 Baltimore, Kansas City, Missouri 64108, (816) 842-9009.

**DAVENPORT, IOWA** announces their Fourth Annual Hamfest, Sunday, February 23, 1975, at the Mount Joy Airport, north of I-80 (Brady Street exit) on Highway 61. Advance tickets, $1.50; door, $2.00. For tickets or information write KØHSC, 1711 West 15th St., Davenport, Iowa 52804.

**FREE:** 12 Extra crystals of your choice with the purchase of a new Regency HR-2B at $229. Send cashier's check or money order for same-day shipment. For equally good deals on Collins, Drake, Ten-Tec, Kenwood, Swan, Atlas, Standard, Clegg, Icom, Genave, Tempo, Venus, Alpha, Hy-Gain, CushCraft, Mosley, and Hustler, write to Hoosier Electronics, your ham headquarters in the heart of the Midwest. Become one of our many happy and satisfied customers. Write or call today for our low quote and try our individual, personal service. Hoosier Electronics, R.R. 25, Box 403, Terre Haute, Indiana 47802. (812) 894-2397.

**FM-YOUR KNIGHT** TR-108 Complete kit. Use xtal-vfo. 19.95ppd. Check or M.O. Calif. res. 6%. Revilo Color, 4725 W. Washington Bl., Los Angeles, CA 90016.

**FOR SALE:** Heathkit DX-60B Transmitter & HG-10B VFO, mint condition, $65. Richard W. Morofsky, PO Box 11, Nemacolin, PA. 15351, (412) 966-5525.

**WANTED:** Vibroplex keyer paddle in good condition. State price. D. Lehto WA7WOC Box 1411, Carefree, Arizona 85331.

**SELL UNIQUE WIRE TUNER** like new $45 Box 8352 Savannah, Georgia 31402.

**TWO PLASTIC HOLDERS FRAME** and display 40 QSL's for $1.00 or 7 holders enhance 140 cards for $3.00 – from your Dealer, or prepaid direct: TEPABCO, Box 198M, Gallatin, Tennessee 37066.

**STANDARD 146A** – 3 months old, with 94/94, 34/94, 73/73, 25/85, 16/76, nicads, charger, rubber ducky and 2 whip antennae, external mike, 2 leather cases, $300.00. Mike Arseni, WA2WCB, 30-91 Crescent St., Astoria, New York 11102. (212) 626-7817, after 1800.

**NC303 RECEIVER** with 2&6 meter converters in seperate cabinet, $350.00; Ameco TX-62 xmtr and VFO Model 621, $175.00; Seneca Heath xmtr. 2&6 meters, $125.00. Write Box J, 73 Magazine, Peterborough, N.H. 03458.

**YOUR SWAP-N-SELL** ads run free in TRADIO, a public service publication of Wichita Amateur Radio Society, Box 4391 Wichita Falls TX 76308.

**FROM UNIVERSITY-Sound** 4 C 15 W Woffers in unopened cartons. Retail $169 each. Will sell at $1.00 each. Write Cassette Headquarters, P.O. Box 482, Jaffrey, N.H.

**NOW PAYING** $2000.00 and up for ARC-94/618T, ARC-102/618T. $1200.00 and up for ARC-51BX. $1500.00 and up for 490T-1 antenna couplers. We also need these control boxes – C-6287/ARC-51BX, C-6476/ARC-51BX, C-714E-2. We also need R-1051 receivers, RT-662/Grc-106 transceivers. We buy all late aircraft and ground radio equipment. Also pack radios. We are buyers not talkers. Bring your equipment in, you are paid on the spot. Ship it in, you are paid within 24 hours. We pay all shipping charges. If you want the best price for your equipment, call us. Call collect if you have and want to sell or trade. We also sell. What do you needD&R Electronics, R.D. 1 Box 56, Milton PA 17847. Phone 717-742-4604. 9:00 AM-9:00 PM.

**MOBILE IGNITION** shielding gives more range, no noise. Everything from economical suppression kits to custom shielding, literature Estes Engineering, 543-A West 184 Street, Gardena CA 90248.

**TWO-METER FM ANTENNAS**, ¼; 5/8W "CARTOP" & Fixed station. Unique designs. Send for literature. MARSH Devices, P.O. Box 154 (a), Old Greenwich, CT 06870.

**MOTOROLA PORTABLES** – Expert repairs, reasonable prices, fast turnaround time. More details and flat rate catalog FREE. Ideal Technical Services, 6663 Industrial Loop, Greendale, WI 53129.

**AMSAT/OSCAR 6-7 SLIDES** – set of 5, $1.25 Lift-off and equipment Proceeds AMSAT. K6PGX P.O. Box 463, Pasadena, CA 91102.

**DAYTON HAMVENTION** at HARA Arena April 25, 26, 27, 1975. Program brochures mailed March 10th. Write for information if you have not attended the last two years to HAMVENTION, P.O. Box 44, Dayton, Ohio 45401.

**WANTED:** Hallicrafters SX-88 for parts, any condition considered. KØMNA, 4805 Sullivan, Wichita, Kansas. 67204.

*More on Page 122*

# GUEST EDITORIALS

## Does Ham Radio Have an Identity Crisis?

Is it possible for hobbies — like humans — to have an identity crisis? Does it seem reasonable that Amateur Radio might be going through the same conflicts, uncertainties and insecurity experienced by people during adolescence or middle age?

Why not? It's nothing to be afraid of as long as it is dealt with candidly and competently. Let's look at some of the symptoms.

*Projection*. . .shafting someone else for characteristics we all share. One example is the attitude towards GRS or citizen band operations. Comment on the air has included put-downs of CB vocabulary and style. Is Amateur Radio somehow supposed to feel better about itself, enhancing our image through ridicule? Listen to 75 and 2 sometimes!

*Defensiveness*. . .usually about an issue internal to ham radio. It is often seen in attempts to explain away limitations in knowledge or skill in order to offset elitism. There should be room for a variety of gifts and interests without feeling intimidated as an "appliance operator", or being more interested in Phone than CW. Instead of feeling hassled or humbled why not do something about developing updating programs for licensed operators.

*Anxiety*. . .almost bordering on paranoia, this feeling is usually directed towards such issues as U.S. frequency allocations, aggressive special interest groups and alleged competition in ham organizations.

*Cynicism*. . .observed when community service projects are discarded as mere ego-trips and sincere efforts to improve the hobby are described as being idealistic.

There are other symptoms, but perhaps the point has been made. And organizations, like individuals, have to learn how to get beneath the symptoms to the underlying causes if answers to the questions "who are we," "where are we going?" are to be found.

The prescription might include cooperation with GRS types (there is one such story in "Operating NEWS"). Why not a field exercise, a community project, even a fraternal delegation to the forthcoming convention? And we can all benefit from a systematic program of skill development. *TOA* will do its share through articles and announcements of opportunities to continue our training. The antidotes for anxiety and cynicism abound. . . there *are* appropriate channels through which our views and interests are presented. . .there *are* individuals and clubs setting high standards of community service. You can support the hobby, help it through its identity crisis in a dozen ways better than brooding and brawling on the bands.

Where is Amateur Radio going? The soundest way to deal with the question is to indentify the issues, evaluate our strengths and weaknesses honestly, and take positive, cooperative and corrective action.

Now.

*The Editor*
*The Ontario Amateur*
*P.O. Box 334*
*Toronto, Ont. M8Z 5P7*

## RF NEWS

Ever heard of Project Sanguine? Or. . .HEMAC?

Did you know that live trees can be operated as a high frequency antenna system?

Read on!

One of the most controversial technical projects is the U.S. Navy's Sanguine program. Basically, it depends on an antenna which is more or less square. Each side of the antenna is 40 to 80 miles long. Even though it is intended to be buried in the earth, naval planners are running into opposition from residents wherever they turn for site planning.

Claiming "environmental" as well as other reasons, people all over just don't want the thing near them. Practically speaking, they do have some cause for concern, as the antenna location could turn out to be a target for enemy missiles.

The reason is that the antennas are part of a long range super-secure communications system. They are intended to convey messages to submerged submarines anywhere in the world.

But the technical aspects of the installations are as interesting as the proposed uses for the equipment. The carrier frequency would be somewhere between 45 to 75 Hz! The rf would be transmitted through the earth's horizontally polarized E field. Submarines, in turn, would be trailing long wire (REALLY long!) antennas. A great deal of the antenna overall length would be shielded in order to get the actual receiving portion out and away from the submarine's own electromagnetic noise field.

The operating range of such systems and at such frequencies is typically about 2,500 miles. Because the antennas, even with their 40 to 80 mile length would be short, they must be insulated from conductive earth. For this reason, planners are seeking sites with large areas of rock shelf, like those which exist in Texas, Wisconsin, Michigan and a few other sites.

Overall output of the system

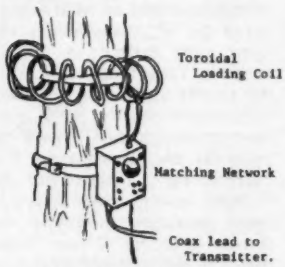
will be on the order of 10 megawatts, based on the use of a grid of 100 amplifiers putting out 100 kilowatts each. Thus, even if several transmitters were disabled for any reason, the remaining ones could continue to power the antenna.

Actual messages will be sent in encoded form using MSK (or minimum shift keying). Navy experts feel that jamming would be next to impossible and probably only result in a slight delay of received messages. Two enemy jammers would actually be required, each at twice the power of a Sanguine system, to affect all operational areas. Now let's get back to that teaser. . .using a pair of trees as a phased antenna.

Yep, it really works! The technique of using a "hybrid electromagnetic antenna coupler," or HEMAC, is credited to Kurt Ikrath, an antenna development specialist working at Ft. Monmouth, N.J.

It all began when the army realized it had difficulty getting HF signals out of jungle growth and heavily wooded areas. The army relies a lot on walkie-talkies or back-pack radios which operate all over the HF spectrum, and which use vertical (whip) antennas.

Well sir, Dr. Ikrath's HEMAC solves the problem just dandy. Essentially, HEMAC consists of a toroidal loading loop and an input matching network. It looks something like this:




Dr. Ikrath says: "You can get radiation out and over the forest, and the improvements have been measured at up to 22 dB over that of a comparable whip antenna, particularly in wet jungles. We've used two trees, four meters apart, as an HF phased array in the Ft. Monmouth area."

By changing the phase difference between the voltages driving the two trees, he was also able to vary the radiation pattern.

But the use of live trees is not the end of the story. Metal utility poles. . .and a human body have also been used. The problem with a "person antenna," he says is that you cannot couple to the belly. "You have to couple to other parts of the body," he says. Fat people, he has found, make better antennas than slim ones. . . and the pattern from the body is highly directional. No explanation for that one. . .yet.

*Ed Bruening W8DTY*
*Reprinted from*
*Action Magazine*
*Box 187*
*Grass Lake MI 49240*

## QRPP MOBILE

Here is a report long overdue, as promised several months ago on QRPP mobile on Manor Lake. I originally planned to use my canoe and see what would happen. For convenience the plan was slightly modified. The boat my 12' Star Craft Pram outfitted with a 6HP MOTOR along with an electric motor powered by a 12 volt auto battery was substituted. The antenna used, a hustler mobile mounted to the bow with 20, and 15 meter resonators. The rig an Argonaut 5 watt input. One hand key an astatic mobile microphone. The plan was simple, from my camp site on Manor Lake, "part of Penn Manor Club", I motored out to the middle of the lake dropped anchor and was ready to go. Using the auto battery as power the rig took the load of the mobile antenna just fine. I started on 20 meter phone and worked Texas, and California in about 30 minutes of operating. Then switching to 15 meter phone no contacts were made, but several stations were heard. Going to 15 CW a little more success was had. One novice in Alabama just could not believe it. On 20 CW 5 stations were worked with average report 479. The total time spent just over two hours. Getting the rig back to dry land I finished the day fishing. The antenna removed easily. Seems like a practical way to blend my two favorite hobbies, QRP and fishing. The rig used is a bit expensive to use precariously; I am again modifying my HW7 which will eventually be my knock around rig. Future plans call for the HW7 to be my main portable rig, and in particular mobile CW on 20 and 15. But I suspect a power supply separate from auto supply will be necessary while in motion.

In summary my objective was met. I spaned easily 3,000 miles East Coast—West Coast. There is no doubt in my opinion considerably less power could have been used with equal success. More attention to the time and frequency used is far more important than power used. In all fairness I should report more stations failed to respond to my call than did. But that is the fun of it. At home I expect all stations to come back as I have an elaborate station with plenty of power. This just makes it more sporting and that is what it is all about. In my case at least.

**Bob WA3HBT**

*Reprinted from the*
*X-Mitter*
*Penn Wireless Assn.*
*138 No. Bellevue Ave.*
*Langhorne PA 19047*

## THE PIRI REIS MAPS

As members of MARCO are aware, I am a geophysicist and admit of very little knowledge of cartography. In the various disciplines of geophysics various types of maps must be used. I find myself employing topographic, geological and terrestrial magnetic maps, to name a few, but the most of these are based upon the well known Mercator projection. Seismology, at times, requires a special type of non-Mercator projection known as "stereographic." As a non-cartographer I am relay-

ing items that have been told me. I am not an authority!

Science is discovering that peoples of the past, and from many parts of the world travelled extensively in exploration. They charted their journeys and despite crude navigational equipment, produced excellent if not accurate maps. In the more "advanced" countries, especially in the Mediterranean area, maps were confiscated from an enemy and considered as valuable booty. Some of these come down to the present and cartographers are attempting solution of the various projections.

One of the common projections used prior to and during the middle ages is known as the "Portolano" projection. The name is of old Italian derivation and the maps gave sailing directions, port locations, coastal features and rhumb lines. These latter lines denoted compass headings but other vectors may have been designated. A latitude and longitude grid was not included, although principal cities were points of projection. The Piri Reis maps were of the Portolano type. Piri Reis (ca. 1500 A.D.) was an admiral of the Ottoman Empire and of a family famous for its' navigators. He wrote extensively on the maps prior and current to his time. In 1513, he supposedly compiled a map of the world, and having had a former sailor of Columbus in his employ utilized some of Columbus' maps. Columbus, in turn, is supposed to have used some of Reis ' maps during his trans-Atlantic voyages. Piri Reis copied from many older maps including some of Alexander's (356-323 B.C.) and some thousands of years prior to that warrior's time. His 1513 map of the world was lost, but recently, supposed parts of this work have been rediscovered.

Shortly after World War II, the U.S. Hydrographic Office found in its' files some ancient maps that bore little resemblance to modern projections. A Captain Arlington H. Mallery, engineer and cartographer, was called in and he recognized them as Portolano's and possibly parts of the Pire Reis 1513 map. Mallery was able to translate them to a Mercator projection. The portions including North and South America were very accurate, but the parts most interesting to myself were areas of Greenland and Antarctica.

Greenland, in this map is composed of three islands with a major fjord trending northeast-southwest and a minor one trending northwest-southeast. From recent seismic soundings we know that bedrock is thousands of feet below sea level in these areas. In certain areas of Antarctica where no land is shown on these ancient maps, seismic studies of mine in 1955-1956 shows land well below sea level beneath the ice of today. Later seismic surveys than mine demonstrated similar conditions. These findings of Captain Mallery and myself were presented at a Forum at Georgetown University, Washington, D.C. on August 26, 1956. The participants were Captain Mallery, a Mr. M. I. Walters, cartographer, and formerly with the U.S. Hydrographic Office, and myself.

Since that presentation, several fictional and pseudo-scientific books have quoted and misquoted this Forum to further their own theses. One theme that is recurrent, tries to prove the existence of extra-terrestrial explorers photographing earth areas from UFOs during preglacial times, or at least a million years ago. Some of the books refer to me as the "noted cartographer" who solved the projections. As stated above, this is quite inaccurate.

In closing, I believe that many of the Portolano maps are quite accurate and the ages ascribed them may be believed. Some may feel that the beginning of civilization in the western hemisphere began after 1492 A.D. We have extensive evidence in South America, at least, that engineering, medicine, surgery, the arts, etc. existed at least two millenia previous to Columbus. 1492 was not the year when the earth was proven not to be flat. Eratosthenes had proven it to be a sphere about the year 200 B.C. and his computed circumference of the earth compares rather closely to our present figure.

While it is possible that land and sea explorations were effected thousands of years ago and that these journeys were charted, I do have difficulties, in the light of our present glaciological knowledge, in believing that these early explorers found the polar regions completely stripped of ice cover. It is possible that some interglacial stages existed, even warmer than the present one, when explorers encountered a partial ice recession and gave the opportunity for the cartographers of those ages to extrapolate below the thinner ice of the time, and determine the land profile as we are doing it by seismic methods today. Some ice cores taken at great depths in Antarctica today have been dated to be hundreds of thousands of years old, which precludes a complete absence of ice.

Reverend Daniel Linehan, S.J.
W1HWK

*Reprinted from the*
*Medical Amateur Radio Council*
*P.O. Box 229*
*Manchester CT 06040*

## WHAT DO YOU CALL ?

### WHAT DO YOU CALL #?

Seems so simple doesn't it? Apparently there has been a problem everywhere on what exactly to call the "#", the symbol on the lower right button of the 12 button "Touchtone" pad. Well the people at Western Electric's Indianapolis Works, who have been producing the TT pads for years say the name for the # is "number sign". This was brought to light recently when a rumor began spreading indicating the correct name for # was "Octothorp" – this certainly is not true says AT&T, the parent organization.

Of course the subject could end there, and we could all start calling #, "number sign". But WA4JZX did a little more research on the matter. A check with about 25 universities and

## C-MOS

| | 1–9 | 10 up |
|---|---|---|
| 4000AE | $ .56 | .53 |
| 4001AE | .54 | .53 |
| 4002AE | .54 | .53 |
| 4004AE | 5.90 | 5.90 |
| 4006AE | 3.90 | 3.70 |
| 4007AE | .65 | .60 |
| 4008AE | 3.60 | 3.30 |
| 4009AE | .95 | .94 |
| 4010AE | .95 | .94 |
| 4011AE | .54 | .53 |
| 4012AE | .54 | .53 |
| 4013AE | 1.15 | 1.05 |
| 4014AE | 3.70 | 3.26 |
| 4015AE | 3.80 | 3.70 |
| 4016AE | 1.15 | 1.05 |
| 4017AE | 2.90 | 2.70 |
| 4018AE | 3.20 | 3.06 |
| 4019AE | 1.30 | 1.20 |
| 4020AE | 3.90 | 3.30 |
| 4021AE | 3.80 | 3.60 |
| 4022AE | 2.75 | 2.55 |
| 4023AE | .54 | .53 |
| 4024AE | 2.30 | 2.00 |
| 4025AE | .54 | .50 |
| 4026AE | 9.80 | 7.10 |
| 4027AE | 1.35 | 1.22 |
| 4028AE | 2.95 | 2.75 |
| 4029AE | 5.40 | 4.60 |
| 4030AE | 1.25 | 1.05 |
| 4035AE | 2.85 | 2.60 |
| 4040AE | 4.60 | 4.40 |
| 4041AE | 3.30 | 3.20 |
| 4042AE | 2.95 | 2.85 |
| 4043AE | 2.95 | 2.85 |
| 4044AE | 2.95 | 2.85 |
| 4047AE | 3.70 | 3.60 |
| 4048AE | 1.50 | 1.40 |
| 4049AE | 1.35 | 1.05 |
| 4050AE | 1.35 | 1.05 |
| 4056AE | 3.50 | 3.46 |
| 4060AE | 5.20 | 4.90 |
| 4066AE | 3.20 | 2.90 |
| 4069AE | .85 | .75 |

## Schottky TTL

| | |
|---|---|
| SN74S00N | $ .80 |
| SN74S02N | .80 |
| SN74S03N | .80 |
| SN74S04N | .80 |
| SN74S08N | .80 |
| SN74S10N | .80 |
| SN74S11N | .80 |
| SN74S20N | .80 |
| SN74S30N | .80 |
| SN74S32N | .80 |
| SN74S40N | .80 |
| SN74S41N | .80 |
| SN74S64N | .80 |
| SN74S74N | 1.50 |
| SN74S85N | 6.10 |
| SN74S86N | 2.90 |
| SN74S112N | 2.50 |
| SN74S113N | 1.50 |
| SN74S133N | 1.00 |
| SN74S138N | 4.50 |
| SN74S139N | 3.90 |
| SN74S140N | 1.00 |
| SN74S151N | 3.30 |
| SN74S153N | 3.30 |
| SN74S154N | 3.40 |
| SN74S157N | 2.70 |
| SN74S158N | 3.00 |
| SN74S160N | 6.60 |
| SN74S161N | 6.60 |
| SN74S174N | 4.75 |
| SN74S175N | 4.00 |
| SN74S181N | 11.50 |
| SN74S189N | 5.10 |
| SN74S194N | 3.30 |
| SN74S195N | 4.40 |
| SN74S251N | 4.20 |
| SN74S253N | 4.20 |
| SN74S275N | 3.20 |
| SN74S287N | 3.70 |
| SN74S260N | .90 |
| SN74S288N | 5.70 |
| SN74289N | 6.00 |
| 93510 | 6.80 |
| 93516 | 6.80 |
| 93521 | 3.50 |
| 93522 | 3.20 |
| 93648 | 3.70 |

## HIGH SPEED TTL

| | |
|---|---|
| 74H00N | .34 |
| 74H01N | .40 |
| 74H04N | .36 |
| 74H05N | .38 |
| 74H08N | .44 |
| 74H10N | .44 |
| 74H11N | .44 |
| 74H15N | .38 |
| 74H20N | .39 |
| 74H40N | .36 |
| 74H74N | .69 |

## 1-Amp Rectifiers

| | 10 | 100 | 1000 |
|---|---|---|---|
| 1N4001 | $ 1.00 | 7.00 | 60.00 |
| 1N4002 | 1.10 | 8.00 | 70.00 |
| 1N4003 | 1.20 | 9.00 | 80.00 |
| 1N4004 | 1.30 | 10.00 | 90.00 |
| 1N4005 | 1.40 | 11.00 | 100.00 |
| 1N4006 | 1.50 | 12.00 | 110.00 |
| 1N4007 | 1.60 | 13.00 | 120.00 |

SPECIFICATION SHEETS: $.25 ea.

## Waveform Generator Kit

XR205K Only $28.00

Here's a highly versatile lab instrument at a fraction of the cost of conventional unit. Kit includes two XR205 IC's, data & applications, PC board (etched & drilled, ready for assembly) and detailed instructions.

## FM Stereo Demodulator

XR1310 $3.90

## Audio Amps

LM383: 8-15V, 1.18W, 8Ω — 1.80
LM384A: 6-27V, 2.80W, 8Ω — 2.50
TAA611B12: 6-15V, 1.15W, 8Ω — 1.60
TAA621A12: 6-27V, 1.40W, 8Ω — 2.00
TBA641B11: 6-18V, 2.20W, 4Ω — 3.00
TBA800: 5-30V, 4.70W, 8Ω — 2.35
TBA810AS: 4.20V, 2.50W, 4Ω — 3.00
TBA820: 3-16V, 0.70W, 4Ω — 1.70
TCA830: 5-20V, 2.00W, 4Ω — 2.25
TCA940: 6-24V, 6.50W, 8Ω — 4.40

## DUAL LOW NOISE OP AMP

LM331N:
$V_{os}$ = 6mV
$I_{os}$ = 1000nA
$I_b$ = 2000nA
Noise = 1.5dB
$2.20

## Power Transistors

| | | | |
|---|---|---|---|
| BU204 | 3A | 1300V | $4.14 |
| BU205 | 3A | 1500V | 4.96 |
| BU205 | 3A | 1700V | 5.94 |
| BU207 | 6A | 1300V | 5.85 |
| BU208 | 6A | 1500V | 6.93 |
| BU209 | 6A | 1700V | 8.64 |

| | |
|---|---|
| 2N5128 | $3.00 |
| 2N1136 | 1.80 |
| 2N1483 | 1.20 |
| 2N1534 | 1.00 |
| 2N1540 | 1.10 |
| 2N1544 | .90 |
| 2N3053 | .25 |
| 2N3055 | .95 |
| 2N3375 | 5.50 |
| 2N3442 | 2.20 |
| 2N3730 | 1.70 |
| 2N3731 | 2.00 |
| 2N3732 | 1.50 |
| 2N3771 | 2.20 |
| 2N3772 | 2.30 |
| 2N3773 | 3.40 |
| 2N3789 | 3.00 |
| 2N3866 | .95 |
| 2N4347 | 1.60 |
| 2N4348 | 2.00 |
| 2N4396 | 1.30 |
| 2N4427 | 1.10 |
| 2N5109 | 2.10 |
| 2N5322 | .92 |
| 2N5323 | .70 |
| 2N6099 | .80 |
| 2N6101 | .80 |
| 2N6103 | .90 |

## HYBRID POWER AMPLIFIERS

| | | |
|---|---|---|
| SI-1010G | 10W | $ 6.90 |
| SI-1020G | 20W | 9.90 |
| SI-1030G | 30W | 18.70 |
| SI-1050G | 50W | 26.90 |

## Digital Watch

with liquid crystal display. Beautiful, reliable and accurate. $149.00 plus $2.50 for shipping and handling.

## Memories

| | |
|---|---|
| P1101A | $6.90 |
| P1101A1 | 8.50 |
| P1402A | 7.90 |
| P2102 | 18.00 |
| P3101 | 5.50 |
| P3101A | 9.50 |
| MM6566N | 5.00 |
| MM6661N | 5.00 |
| DM8599N | 5.00 |
| 93403 | 5.00 |

## Decoded Read/Write RAM

P1103 $8.20

## Calculator

LIMITED QUANTITY

$19.00

## 9-Digit Display

$7.90

- 1/8" character height
- compact, thin PC package
- wide viewing angle

## Displays

| | | |
|---|---|---|
| SLA1 | Red | $2.25 |
| SLA11 | Green | 4.25 |
| SLA21 | Orange | 4.25 |
| SLA2 | ±1 Red | 2.25 |
| SLA12 | ±1 Grn | 2.25 |
| SLA22 | ±1 Org | 2.25 |
| SLA3 | Red | 7.50 |
| SLA4 | Red | 7.50 |
| XAN72 | Red | 2.50 |
| XAN82 | Green | 2.50 |

## Optoisolator

MCT2 1.45

MV50 Red $ .36

## LED's

### .125" dia.

| | | |
|---|---|---|
| 209 | Red | $ .25 |
| 209 | Yellow | .25 |
| 209 | Green | .35 |

### .160" dia.

| | | |
|---|---|---|
| 216 | Red | .25 |
| 216 | Yellow | .30 |
| 216 | Green | .30 |

### .200" dia.

| | | |
|---|---|---|
| 220 | Red | .25 |
| 220 | Yellow | .30 |
| 220 | Green | .30 |

LOW PROFILE

| | | |
|---|---|---|
| 226 | Red | $ .25 |
| 226 | Yellow | .30 |
| 226 | Green | .30 |
| 226 | Orange | .30 |

| | | |
|---|---|---|
| 5083 | Red | $ .35 |
| 5083 | Yellow | .40 |
| 5083 | Green | .40 |
| 5083 | Orange | .40 |

216 = MV5024
5083 = MV5053

## Voltage Regulators

| | |
|---|---|
| LM100H | $ 5.50 |
| LM104H | 6.50 |
| LM105H | 5.10 |
| LM105F | 8.50 |
| LM108H | 9.50 |
| LM109K | 6.30 |
| LM200H | 3.80 |
| LM204H | 4.70 |
| LM205N | 3.00 |
| LM209H | 3.50 |
| LM209K | 3.70 |
| LM300H | .90 |
| LM300N | 1.40 |
| LM304H | 1.40 |
| LM305H | 1.10 |
| LM305AH | 1.40 |
| LM305N | 1.20 |
| LM309H | 1.75 |
| LM309K | 1.95 |
| LM340-05K | 2.60 |
| LM340-06K | 2.60 |
| LM340-08K | 2.60 |
| LM340-12K | 2.60 |
| LM340-15K | 2.60 |
| LM340-18K | 2.60 |
| LM340-24K | 2.60 |
| LM723H | 1.30 |
| LM723D | 3.90 |
| LM723CH | .80 |
| LM723CN | .75 |
| L129 | 1.50 |
| L130 | 1.50 |
| L131 | 1.50 |
| SG4501T | 2.20 |
| SG4501N | 2.20 |

## Linear IC's

| | | |
|---|---|---|
| LM114H | TO-5 | $ 3.00 |
| LM301A | TO-5 | .90 |
| LM301AM | Mini-dip | .75 |
| LM301AN | Dip | 1.10 |
| LM302H | TO-5 | .95 |
| LM302N | Dip | 1.40 |
| LM306H | TO-5 | 2.80 |
| LM306N | TO-5 | .90 |
| LM307M | Mini-dip | .90 |
| LM308H | TO-5 | 1.20 |
| LM308AH | TO-5 | 5.00 |
| LM310H | TO-5 | 1.40 |
| LM311H | TO-5 | 1.70 |
| LM318H | TO-5 | 2.50 |
| LM556CM | Mini-dip | .90 |
| LM709CH | TO-5 | .45 |
| LM709CN | Dip | .45 |
| LM710CH | TO-5 | .60 |
| LM710CN | Dip | .75 |
| LM715CH | TO-5 | 4.30 |
| LM725CH | TO-5 | 5.00 |
| LM733CH | TO-5 | 1.50 |
| LM733CN | Dip | 1.50 |
| LM741CH | TO-5 | .45 |
| LM741CM | Mini-dip | .44 |
| LM747CH | TO-5 | 1.90 |
| LM747CN | Dip | .90 |
| LM748CN | Dip | .40 |
| LM3046CN | Dip | .95 |
| LM3054CN | Dip | 1.50 |

## Phase Locked Loops

LM567CM Mini-dip 2.10

## IC Power Regulators

| | |
|---|---|
| LM335K: 5V, 600mA | 2.40 |
| LM336K: 10V, 500mA | 2.90 |
| LM337K: 15V, 450mA | 2.90 |

## Pulse Generator

Interdesign 1101: 0.1Hz-2MHz, 0-5V Output, var. width, line or battery operation. $159.00.

## Z524V Recirculating 512 Bit Dynamic Shift Register

1–24: $4.00 / 25 up: $3.90

## Shift Registers

| | | |
|---|---|---|
| 1402A | $ 7.90 | |
| 1403A | 6.00 | |
| 1404A | 6.00 | |
| 1405A | 4.50 | |
| 1406 | 6.00 | |
| 1407 | 6.00 | |
| 1506 | 3.00 | |
| 1507 | 3.00 | |
| 2505K | 4.00 | |
| 2512K | 6.50 | |
| 2524V | 4.00 | |
| 2525V | 6.50 | |
| 2533V | 10.90 | |
| 2807 | 4.00 | |
| 2905 | 6.50 | |
| 2914DC | 8.20 | |
| MM5055N | 5.00 | |
| MM5056H | 5.00 | |
| MM5057N | 5.00 | |
| MM5058N | 10.90 | |
| TMS3114J | 9.50 | |
| TMS3133NC | 10.90 | |

## 9300 SERIES

| | |
|---|---|
| 9300PC | $1.00 |
| 9301PC | 1.20 |
| 9304PC | 1.50 |
| 9306PC | 6.90 |
| 9308PC | 2.50 |
| 9309PC | 2.50 |
| 9310PC | 1.80 |
| 9311PC | 2.50 |
| 9312PC | 1.20 |
| 9314PC | 1.30 |
| 9316PC | 1.50 |
| 9320PC | 2.30 |
| 9321PC | 1.20 |
| 9322PC | 1.30 |
| 9324PC | 2.50 |
| 9328PC | 2.50 |
| 9334PC | 2.98 |
| 9338PC | 3.30 |
| 9340PC | 5.00 |
| 9341PC | 4.10 |
| 9342PC | 1.15 |
| 9360PC | 1.75 |
| 9368PC | 1.75 |

## TWO PHASE MOS CLOCK DRIVER

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## IC sockets

| Solder | | Teflon | |
|---|---|---|---|
| | | 3 pin TO-5 | .55 |
| | | 4 pin TO-5 | .65 |
| 8 pin DIL | .22 | 6 pin TO-5 | .90 |
| 14 pin DIL | .26 | 8 pin TO-5 | 1.10 |
| 16 pin DIL | .28 | 10 pin TO-5 | 1.40 |
| 24 pin DIL | .75 | | |
| 28 pin DIL | 1.10 | Wire Wrap | |
| 36 pin DIL | 1.70 | 14 pin DIL | .40 |
| 40 pin DIL | 1.90 | 16 pin DIL | .45 |

## 1024 Bit N-Channel RAM

| | |
|---|---|
| 2602S | $21.00 |
| 2602-1S | 25.00 |
| 7552CPE | 21.00 |
| 7552-1CPE | 25.00 |

## 7400N TTL

| | | | | | |
|---|---|---|---|---|---|
| 7400N | $ .16 | 7430N | .22 | 74141N | 1.79 |
| 7401N | .23 | 7432N | .26 | 74145N | .79 |
| 7402N | .22 | 7437N | .44 | 74147N | .95 |
| 7403N | .22 | 7438N | .44 | 74148N | 3.99 |
| 7404N | .25 | 7440N | .19 | 74150N | $ 1.14 |
| 7406N | .29 | 7441AN | 1.16 | 74151N | .75 |
| 7407N | .48 | 7442N | .98 | 74152N | 2.25 |
| 7408N | .54 | 7445N | .98 | 74153N | 1.12 |
| 7410N | .24 | 7446N | .98 | 74154N | 1.63 |
| 7411N | .29 | 7447N | 1.50 | 74155N | 1.49 |
| 7412N | .51 | 7448N | 1.20 | 74156N | 1.49 |
| 7413N | .78 | 7450N | .23 | 74157N | 1.19 |
| 7414N | 2.81 | 7451N | .28 | 74158N | 1.54 |
| 7416N | .46 | 7453N | .25 | 74160N | 1.50 |
| 7417N | .64 | 7454N | .25 | 74161N | 1.35 |
| 7418N | .19 | 7460N | .23 | 74162N | 1.50 |
| 7421N | .51 | 7470N | .30 | 74165N | 1.89 |
| 7423N | .49 | 7472N | .38 | 74166N | 1.98 |
| 7425N | .39 | 7473N | .46 | 74170N | 2.85 |
| 7426N | .29 | 7474N | .38 | 74172N | 1.79 |
| 7427N | .35 | 7475N | $ .68 | 74174N | 1.52 |
| 7428N | .51 | 7476N | .59 | 74175N | 1.50 |
| 7430N | .22 | 7480N | .66 | 74176N | 1.69 |
| 7432N | .26 | 7481N | 1.21 | 74177N | 1.69 |
| 7437N | .44 | 7482N | 1.01 | 74180N | 2.49 |
| 7438N | .44 | 7483N | 1.01 | 74181N | 3.85 |
| 7439N | 1.01 | 7484N | 1.40 | 74182N | 1.19 |
| 7440N | .19 | 7485N | 2.49 | 74184N | 2.89 |
| 7441AN | 1.16 | 7486N | .49 | 74185N | 2.29 |
| 7442N | .98 | 7489N | 2.99 | 74190N | 2.89 |
| 7445N | .98 | 7490N | .78 | 74191N | 2.89 |
| 7446N | 1.50 | 7491N | 1.40 | 74192N | 1.49 |
| 7447N | 1.50 | 7492N | .84 | 74193N | 1.39 |
| 7448N | 1.20 | 7493N | .84 | 74194N | 1.35 |
| 7450N | .23 | 7495N | .88 | 74195N | .99 |
| 7451N | .28 | 7496N | .88 | 74198N | 2.99 |
| 7453N | .25 | 7497N | 2.50 | 74199N | 4.48 |
| 7454N | .25 | 74100N | 1.45 | 74200N | 5.95 |
| 7460N | .24 | 74107N | .54 | 74221N | 1.75 |
| 7470N | .30 | 74109N | .91 | 74251N | 1.75 |
| 7472N | .38 | 74110N | .71 | 74298N | 2.95 |

## LOW POWER TTL

| | | | |
|---|---|---|---|
| 74L00N | $ .34 | 74L92N | .84 |
| 74L02N | .34 | 74L93N | .84 |
| 74L03N | .39 | 74L95N | 1.62 |
| 74L04N | .39 | 74L96N | 1.62 |
| 74L10N | .34 | 74L98N | 1.74 |
| 74L20N | .39 | 74L99N | 1.74 |
| 74L42N | 1.62 | 74L164N | 2.60 |
| 74L47N | 2.60 | 74L165N | 2.60 |
| 74L51N | .34 | 74L173N | .74 |
| 74L73N | .74 | 74L174N | .89 |
| 74L74N | .89 | 74L175N | 1.62 |
| 74L86N | 1.62 | 74L193N | 1.74 |
| 74L90N | 1.62 | 74L195N | 1.62 |

| | | | |
|---|---|---|---|
| 93L00 | 1.50 | 93L10 | 2.80 |
| 93L01 | 1.60 | 93L11 | 4.20 |
| 93L08 | 3.20 | 93L12 | 1.80 |
| 93L09 | 1.80 | 93L14 | 1.70 |
| 93L10 | 2.80 | 93L16 | 3.20 |
| 93L11 | 4.20 | 93L18 | 3.50 |
| 93L12 | 1.80 | 93L21 | 1.50 |
| 93L14 | 1.70 | 93L22 | 1.80 |
| 93L16 | 3.20 | 93L24 | 2.80 |
| 93L18 | 3.50 | 93L28 | 3.70 |
| 93L21 | 1.50 | 93L34 | 4.00 |
| 93L22 | 1.80 | 93L36 | 4.20 |
| 93L24 | 2.80 | 93L38 | 4.20 |
| 93L28 | 3.70 | 93L40 | 6.50 |
| 93L34 | 4.00 | 93L41 | 6.50 |
| 93L36 | 4.20 | 93L60 | 3.00 |
| 93L38 | 4.20 | 93L66 | 2.70 |

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| | |
|---|---|
| DM8820N | 4.00 |
| DM8820AN | 6.50 |
| DM8830N | 4.50 |
| DM8831N | 5.00 |
| DM8832N | 6.00 |
| 9600 | 1.30 |
| 9601 | 1.30 |
| 9602 | 2.00 |
| 9614 | 3.00 |
| 9615 | 3.00 |
| 9616 | 4.50 |
| 9617 | 3.00 |
| 9620 | 3.50 |
| 9621 | 3.00 |

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| CY1020 | Instr. Amp., FET Input | 34.00 |
| CY1021 | Instr. Amp., FET Input | 49.00 |
| CY1021A | Instr. Amp., FET Input | 59.00 |
| CY2018 | DAC, 8 Bit, 2 Quad Multiplying | 99.00 |
| CY2137 | DAC, 10 Bit, Low Drift | 39.00 |
| CY2218 | DAC, 12 Bit, 2 Quad Multiplying | 149.00 |
| CY2236 | DAC, 12 Bit, Fast Settling, Low Drift | 89.00 |
| CY2237 | DAC, 12 Bit, Low Drift | 69.00 |
| CY2735 | DAC, 4 Digit BCD, Low Cost | 79.00 |
| CY2737 | DAC, 4 Digit BCD, Low Drift | 139.00 |
| CY3035 | ADC, 8 Bit, Sect. Counting, Low Cost | 89.00 |
| CY3636 | ADC, 3 Digit BCD, Sect. Count, Low Cost | 119.00 |

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several different departments within, including the reference libraries of many like: USC, UCLA, University of Colorado, NC State, UNC, College of William and Mary, Princeton, Old Dominion, etc. . .has revealed that the symbol actually has no official name, but has many uses including:

In Music. . . "sharp"

In Medicine. . . "fracture"

In Proofreading. . . "leave a space"

Preceeding a number. . . "number"

After a number. . . "pounds"

The closest actual name that has some geometrical logic occurred in one old dictionary at the College of William and Mary in Williamsburg, Virginia – that name is "crosshatch."

Looks like this just results in one more item for which the amateur must develop a "standard" name. Any more suggestions?

*Reprinted from the Carolinas-Virginia Repeater Assn.*

## MOBILE THEFT: ARE YOU INSURED??

Each of us operating a mobile has a rather large investment in gear on display in our cars. Theft of this equipment would not only be a great inconvenience, but also a substantial loss. Most of us figure that somehow or other our insurance would cover such an occurance, but many of us are in for a great surprise. To find out facts concerning this, several insurance company claims adjustors were approached, and here's what was discovered:

1. Many policies have a rider that refers to "sound-reproducing" type systems. Ham radio is not excluded from a policy by this rider, as it refers to a tape system;

2. Insurance coverage which does nothing more than meet state requirements to buy license tags will not cover theft;

3. Collision/Theft Insurance is what's required, and it is available to cover a *permanent* installation;

4. Presence of a burglar alarm system, or call letter license plates have absolutely no bearing whatsoever on the decision of what is a permanent installation;

5. In the case of an under-dash installation, the case of the radio must be bolted to the car. Installations that slide in and out with clips to hold the set are NOT permanent;

6. For trunk mounted rigs with dash mounted control head, answers varied. Some adjusters said the rig would be covered, others said no.

If you are not sure about whether or not you are covered, the only true means of determining this is to take your installation and insurance policy to your agent, and discuss it with him. But do it now, before it's too late and your rig turns up missing.

**. . . WA4LYL**

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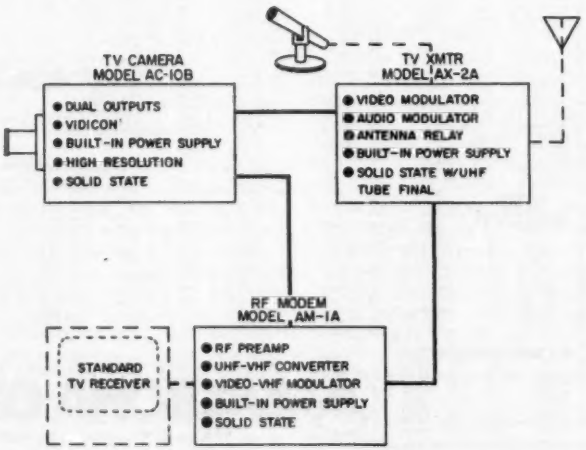


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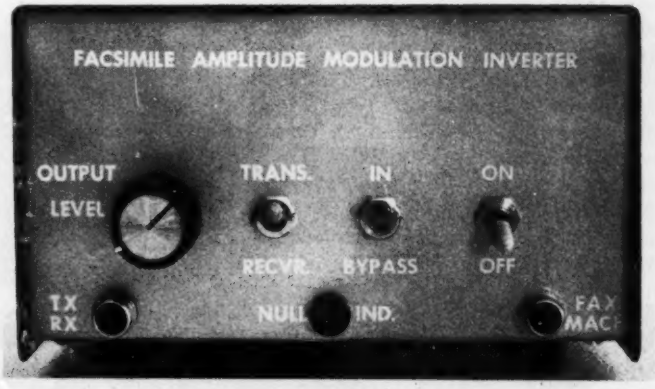



*Michael R. Berge K7QXL*
*6019 So. 118th Place*
*Seattle WA 98178*

# *Using the W.U. Desk Fax*

Simple fax converter for ham use.

During the last few years Western Union has surplused hundreds of their Desk-facsimile machines, and ads for these machines have appeared in 73 Magazine and elsewhere. When properly converted, these inexpensive units produce excellent over the air pictures on the 6m and higher bands where they are legal to use.

Several modifications to the machine, which are necessary for radio transmission, were compiled by W7QCV from various sources and appeared in the May 1972 issue of *QST* (pp. 23-26).

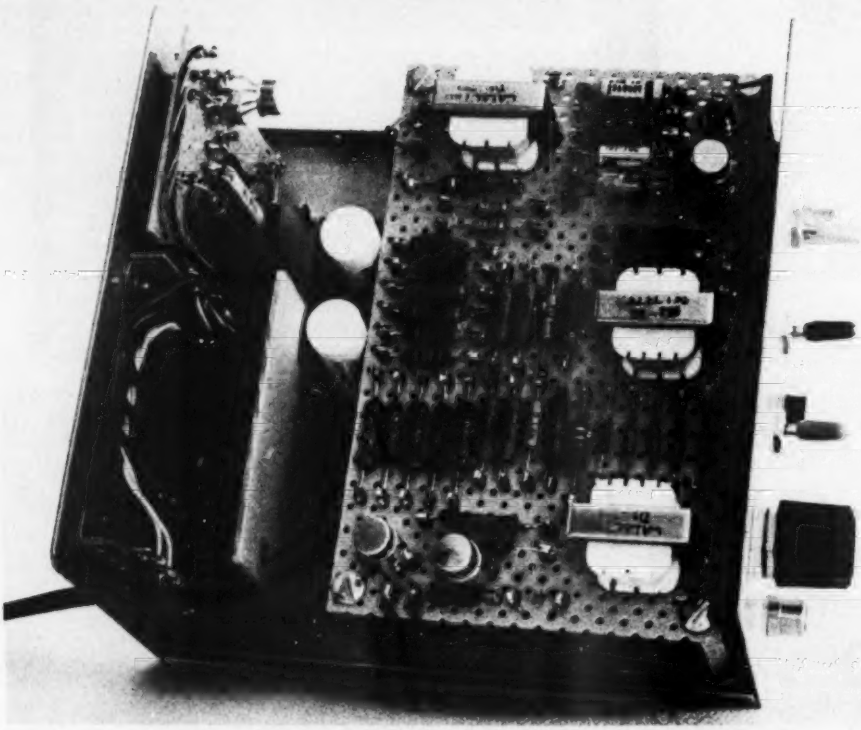
One of the most desirable modifications described in the above article is the use of a short length of plastic fiber optic light pipe to convert the negative picture produced by the machine into a positive picture. Unfortunately, proper adjustment of the light pipe can be very tricky and time consuming. The diameter of the light pipe, its distance away from the chopper wheel and the rigidity of its mounting system can greatly affect the 16dB null which is possible to squeeze out of the arrangement. If the null is not too good, background burning or diagonal lines may appear in the picture.

The difficulties with the light pipe prompted the development of a solid state modulation inverter that could simply be connected to the output of the machine. Another benefit of the converter is that it can take a negative picture off the air and change it into a positive picture.

**Circuit Description**

The modulated 2575Hz video carrier frequency from the Desk-Fax is fed into a forward-biased full-wave rectifier. The forward bias overcomes the diodes' barrier potential, enabling the diodes to start conducting at lower signal levels. Input versus output linearity is therefore enhanced. The output of the rectifier is fed through a simple RC filter into a T-notch filter to reduce the 5150Hz ripple component by approximately 60dB. The time constant of the overall rectifier-filter is such that the full resolution capability of the machine is preserved, an important consideration.

The detected video is then fed into U1, an op amp voltage summing circuit used as an inverter. A fixed negative voltage is applied to the inverting input of U1 along with the positive going video information.



*Interior view of converter.*

This results in a positive voltage at the output of U1 that swings toward 0V as the video input amplitude increases.

Output current from the inverter is used to operate the null indicator lamp circuit through driver transistor Q1. .nverter output is also fed through a 240K resistor and a silicon reverse voltage blocking diode to the balanced modulator, arranged as a current controlled attenuator. Output from U2, connected as a low distortion 2400Hz sine wave generator, is also applied through a T-pad to the balanced modulator. Modulator output voltage is amplified by U3.

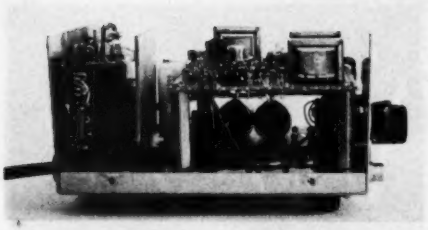
Although the video carrier frequency of the Desk-Fax is on 2575Hz, 2400Hz was chosen as the new carrier frequency. This new lower frequency can pass with little attenuation through the narrow audio bandwidth filters in some of the more modern pieces of equipment used on the VHF bands.

The power supply is conventional. The current requirements for the converter are +10V at 45mA and -10V at 10mA.

**Construction and Adjustment**

An audio oscillator and an oscilloscope should be used to adjust the null point of the T-notch filter and the frequency of the 2400Hz oscillator. The adjustment of the T-notch filter is critical, as the depth of null influences the purity of the carrier output waveform of the converter. Component tolerances in the T-notch filter should be tight. About 45dB of attenuation at 5150Hz should be easily obtained without adjustment but obtaining the desired 55dB to 60dB null may require a very slight change in the value of one or two components. Input and output leads of the T-notch filter should be disconnected from the rest of the converter circuitry during its adjustment.

The 2400Hz oscillator is easily put on frequency by changing slightly the value of



*Side view of converter.*

either one of its two frequency determining capacitors.

Adjust the 250Ω oscillator amplitude control pot for 2.7V rms on pin 6 of U2. With no signal input to the converter, +4.5V dc should be on pin 6 of U1, and a pure sine wave of about 0.75V rms should be on pin 6 of U3.

As shown in Fig. 2 and 3, increasing the amplitude of a 2575Hz sine wave signal applied to the converter input from 0V to about 1.2V rms will cause the 2400Hz carrier output of U3 to smoothly decrease to 0V while maintaining its waveform purity, and the null indicator lamp will extinguish.

The balanced modulator transformers are very susceptible to hum pickup from the power supply transformer. Connect the scope to the output of the converter with the sweep set at 20Hz and position the power transformer in the cabinet so that no ripple is seen superimposed on the 2400Hz carrier before bolting everything down. Also keep the completed converter one or two feet from the Desk-Fax, as the motors in it produce terrific magnetic fields.

Calectro D1-728 transformers were used for T1 through T 3 because they were found to have a very good electrical center tap. A 10V, 20mA lamp can be used in place of the LED and 330Ω resistor if desired. Don't try building the unit without the rf bypassing. Even a small amount of rf in the converter will kill the 2400Hz oscillator.

Make sure the stylus in the Desk-Fax will match the fine reproduction capability of

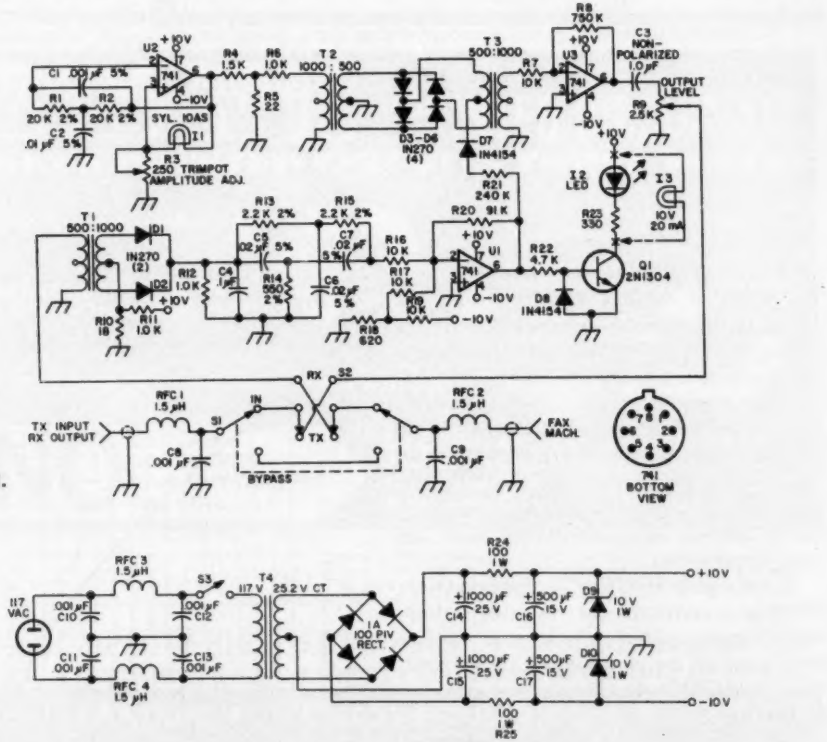



*Fig. 1.*

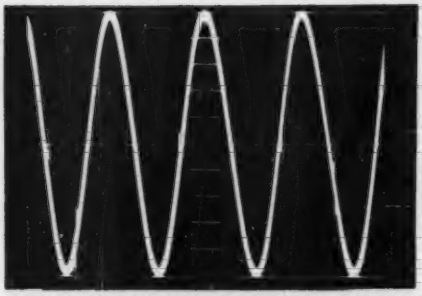


*Fig. 3A.*

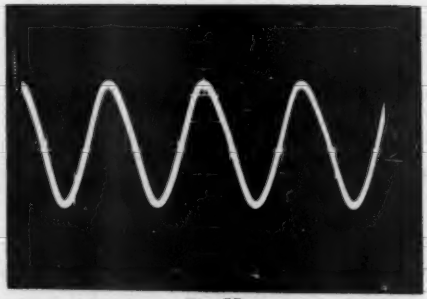


*Fig. 3B.*

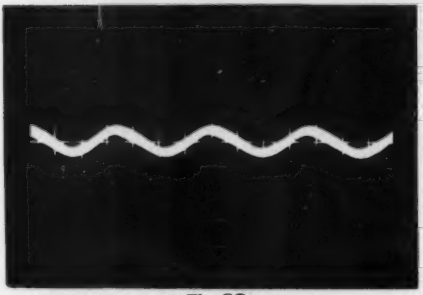


*Fig. 3C.*

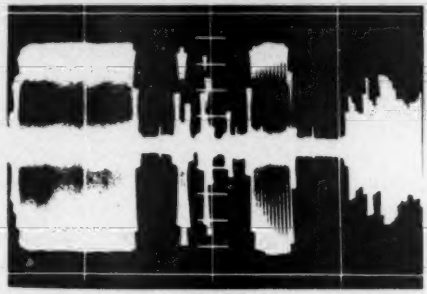


*Fig. 3D.*

*As described in the text, photos A through C show that excellent waveform purity is maintained as the converter's 2400 Hz video carrier output falls toward OV with increasing 2575 Hz signal input. Photo D shows 2400 Hz carrier modulated by video information.*

the unit. WA7LMO found that a length of .2mm diameter guitar wire, available from any music store, will yield hundreds of excellent long wearing styli.

### Operation of the Converter

To use the converter for transmitting stop the drum of the fax machine, rotate the drum so the exciter lamp shines on the whitest area of the picture and simply adjust the machine's transmit gain pot (P2) until the null indicator lamp just extinguishes. If used for receiving a negative picture off the air, the signal should be fairly strong with no QSB. Adjust the receiver gain control so the null indicator lamp flickers vigorously, or during periods of uninterrupted tone the lamp just goes out.

Thanks go to WA7EHE for his rapidity in building a converter for his own station, which greatly aided critical over the air evaluation of the performance of the unit, and to WA7QQI for his photographic enlargements.

... K7QXL

PARTS LIST

All resistors 1/2 watt, 5% carbon unless otherwise indicated.

R1, R2 20,000Ω, 2% film
R3 250Ω, trimmer potentiometer
R4 1500Ω
R5 22Ω
R6, R11, R12 1000Ω
R7, R16, R17, R19 = 10,000Ω
R8 750,000Ω
R9 2500Ω, linear-taper potentiometer

*Cont.*

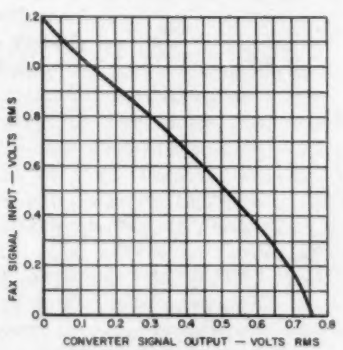



*Fig. 2. Converter input-output linearity.*

## K7QXL Parts List continued.

R10 18Ω
R13, R15 2200Ω, 2% film (two 1100Ω, 2% resistors in series)
R14 550Ω, 2% film (220Ω, 2% in series with 330Ω, 2% resistor)
R18 620Ω
R20 91,000Ω
R21 240,000Ω
R22 4700Ω
R23 330Ω
R24, R25 ≤ 100Ω, 1 watt
C1 .001 μF, 5% polystyrene (Mallory SX210)
C2 .01 μF, 5% polystyrene (Mallory SX110)
C3 1.0 μF, 50 volt paper, non-polarized
C4 .1 μF, mylar
C5, C6, C7 .02 μF, 5% polystyrene (two mallory SX110 .01 μF, 5% capacitors in parallel)
C8, C9, C10, C11, C12, C13 .001 μF, 1000V disc ceramic
C14, C15 1000 μF, 25V electrolytic
C16, C17 500 uF, 15V electrolytic c
D1, D2, D3, D4, D5, D6 1N270 germanium diode (do not substitute)
D7, D8 1N4154 silicon signal diode (or equiv.)
D9, D10 10V, 1 watt, 5% Zener diode (1N4740A)
LED Light-emitting diode, 1500 fL. (Radio Shack 276-026)
I1 10V, 10-14mA lamp (Sylvania 10AS or equiv.)
I2 10V, 20mA pilot lamp (if LED and R23 are not used)
Q1 2N1304 NPN germanium switching transistor (Radio Shack 276-2001)
RECT. 100 PIV, 1 Amp, full-wave bridge rectifier (Motorola MDA920-3)
RFC1, RFC2, RFC3, RFC4 1.5 μH choke (or 3 ferrite beads)
S1, S2 DPDT miniature toggle switch
S3 SPST miniature toggle switch
T1, T2, T3 500Ω ct to 1000Ω ct miniature transistor driver transformer (Calectro D1-728 recommended)
T4 117V primary, 25.2V ct secondary power transformer
U1, U2, U3 741 operational amplifier
Cabinet 13.34cm X 7.62cm X14.92cm(Radio Shack 270-253)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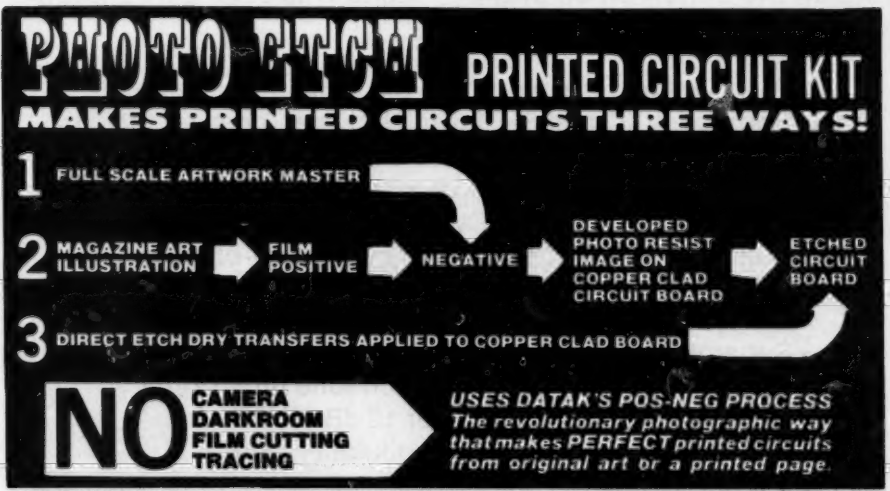
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Ralph E. Taggart WB8DQT
4515 Oakwood Drive
Okemos MI 48864

# How to find the Satellite

## Be it Oscar 7, Oscar 6, or the weather satellites . . .

With the current interest in OSCAR communications satellites as well as the various weather satellites, today's amateur often faces the need for reliable information on the subject of satellite tracking. Although a precise mathematical treatment of the subject could quickly drive most of us out of business, there are a number of quite simple approaches that can be used by amateurs to produce reliable tracking data. Much of the simplification is achieved because amateur antennas in the VHF region are not terribly sharp so that a pointing error of a few degrees is not likely to produce any noticeable effect on either a received or transmitted signal. Very little equipment is required. A world globe is necessary for generating aiming information for the various geosyncronous satellites while some polar coordinate graph paper, some clear acetate plastic sheets, and a compass for drawing circles will be adequate for the near polar orbits of the OSCAR repeaters and the ESSA and NOAA weather satellites.

*Jan King W3GEY AMSAT-OSCAR-B Project Manager and Marie Marr, AMSAT'S Aerospace Technician, with the spacecraft.*

Before getting into the details of tracking it is worthwhile to devote a little space to the subject of satellite orbits in general. Any body in orbit, be it natural or artificial, traces a path in space around the body it is orbiting. In the case of an artificial satellite, the nature of the orbit depends upon the speed and direction of the satellite when it is "injected" into its orbit by the rocket booster. Once established, the nature of the orbit is fixed and remains virtually unchanged. An orbit is effected by the almost immeasurable drag of residual atmosphere at the orbital altitude or by the gravitational forces of the sun and moon, but these forces are not large enough to exert any really perceptable change within the operational lifetime of a satellite. An orbit has two principal parameters, the altitude of the orbital path above the earth's surface and the inclination of the orbit to the earth's equator. The altitude of the satellite is usually expressed by noting the *apogee* or high point in the orbit and its *perigee* or low

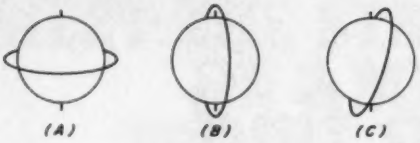


*Fig. 1. Representative orbital paths with varying inclinations. A shows an equatorial orbit (inclination 0° ) in which the path of the satellite is over the equator at all times. B shows a polar orbit (inclination = 90° ) where the satellite crosses both poles on each revolution and crosses the equator at an angle of 90°. C shows a near polar orbit characteristic of NOAA, ESSA, and OSCAR satellites.*

| Antenna Elevation (°) | Great Circle Arc Distance Statute Miles | Kilometers |
|---|---|---|
| 90 | 0 | 0 |
| 80 | 550 | 890 |
| 70 | 1170 | 1880 |
| 60 | 1800 | 2880 |
| 50 | 2420 | 3880 |
| 40 | 3040 | 4880 |
| 30 | 3660 | 5880 |
| 20 | 4280 | 6880 |
| 10 | 4900 | 7880 |
| 0 | 5520 | 8880 |

*TABLE 1. Antenna elevation angle for geosynchronous satellites as a function of great circle distance from the receiving station to the satellite sub-point.*

point. Virtually all of the orbits we will be concerned with will be circular or nearly so (apogee = perigee) and we will treat the mechanics of the orbit as if the orbit were precisely circular. This is a far cry from the early days of the space program where it was sufficient just to get a satellite into orbit, even one with widely differing apogee and perigee values.

Fig. 1 shows several extremes in orbital inclinations. Fig. 1A shows an equatorial orbit (inclination 0°) where the orbital path lies above the equator at all times. 1B shows a polar orbit (inclination 90°) where the satellite passes over the poles during every revolution, crossing the equator at an inclination of 90°. The orbits of OSCAR and weather satellites are nearly polar, coming within 10° of the poles on each orbit.

The position of the satellite at any time is a function of its position along its orbital track and the position of the earth beneath it. When referring to satellite position we will be talking about the satellite *sub-point*, that portion of the earth directly under the satellite at any particular time. The period of the satellite in its orbit (the time required for one revolution of the earth) is directly proportional to its orbital altitude. A weather satellite at an altitude of 800 nautical miles may require 115 minutes to complete an orbit, while the moon, our natural satellite, at an altitude of 240,000 miles requires some 28 days to complete one revolution of the earth. The motion of the satellite in its orbit and the revolution of the earth beneath the satellite (360°/day or 15°/hour) are completely independent so both factors must be taken into consideration in determining the satellite sub-point.

### Geosyncronous Satellites

The orbits of the various geosyncronous satellites are the most elegant orbits but the easiest to visualize and use. Such satellites have equatorial orbits and are located at an altitude of slightly more than 22,000 statute miles. At that altitude an orbital period is precisely 24 hours (1440 minutes). Since the direction of the movement of the satellite in its orbit is the same as the direction of rotation of the earth, the satellite maintains the same position over the equator at all times. Since the position of the satellite with respect to the earth does not change (hence the term geosyncronous), the position of the satellite in the sky when viewed from the earth is also constant. Reception of such satellites is merely a matter of determining the proper antenna bearing and elevation. Once achieved, antenna alignment need not be altered unless the satellite is purposely moved to another position using an internal reaction system. Such geosyncronous satellites are ideal for communications use since antenna bearings need not be changed. Unfortunately, no amateur geosyncronous communications satellites are in our immediate future. The ATS satellites (135.6 MHz) and the SMS/GOES satellites (1691 MHz) do transmit weather pictures and other facsimile data and are thus of interest to weather satellite enthusiasts. In addition to WEFAX relay, the ATS satellites (ATS-1 and ATS-3) are used as experimental repeaters giving

hemisphere wide radio coverage with all the convenience of full quieting FM. A few evenings spent listening to round tables from one side of the Pacific to another will make the local repeater look like small potatoes! A world globe and the data in Table 1 are all you need to compute your proper antenna orientation. The following data show the position (over the equator) of the three geosyncronous satellites of likely interest to amateurs:

| | |
|---|---|
| ATS-1 | 149°W |
| ATS-3 | 70°W |
| SMS-1 | 75°W |

Mark your own location on the globe and the position of the satellite(s) of interest to you. Using a piece of string or the edge of a piece of paper, mark the great circle distance (shortest distance measured on the surface of the globe) between your station and the satellites you wish to receive. The direction of the great circle arc represents your desired antenna bearing. Using the globe mileage scale as a guide, note the great circle distance and refer to Table 1 to interpolate the antenna elevation. The examples in Table 1A show ATS-1 and 3 antenna aiming data for two station locations as an example. Check them out on your globe and then try your own.

In this case, a station in Lansing, Michigan could receive signals from both satellites since they are both above the local horizon. Antenna bearing and elevation would have to be changed, however, in switching from one to the other. The hypothetical Fairbanks station would have ATS-1 above the local horizon and would be in business there, but that station would be out of luck with ATS-3, which would be below the horizon to the SE. Generally speaking, if the great circle distance between the satellite subpoint on the equator and the potential receiving station is greater than 5500 statute miles (8900 km) the satellite will be below the horizon and will not be usable. Generally, in order to maintain full quieting signals the antenna elevation should be 5° or better. Some stations in western Europe will just be able to receive ATS-3. The US plans to place another SMS satellite over the eastern Pacific while the USSR has plans for a similar satellite over the Indian Ocean and Japan will place another over the Western Pacific. For those interested in constructing suitable S band converters, the next few years should provide stations in any part of the world, aside from the highest polar latitudes, with reception potential from at least one of the SMS style meteorological satellites.

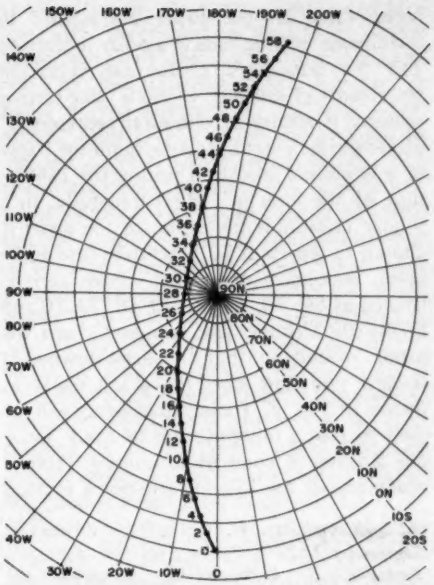


*Fig. 2. Sample satellite track plotted from data in Table 2.*

**Tracking Polar Orbiting Satellites**

The first step is to plot a reference orbital track. Take a piece of the polar coordinate paper. Such a piece of graph paper can be used as a polar map projection and we will use it as such in describing the tracking procedure. With the graph paper in its normal orientation you will note that the

**TABLE 1A**

| Satellite | Station Location | Antenna Bearing | Distance | Antenna Elevation |
|---|---|---|---|---|
| ATS-1 | Lansing, Mich. | SW | 4600 mi. | 15° |
| ATS-3 | Lansing, Mich. | SSE | 2900 mi. | 42° |
| ATS-1 | Fairbanks, Ak. | S | 4500 mi. | 17° |
| ATS-3 | Fairbanks, Ak. | SE | 5900 mi. | --- |

radial lines on the paper correspond to increments of longitude in a polar projection and the concentric circles can represent increments of latitude. If the 0° line (facing upward) is arbitrarily chosen to represent 0° of longitude, you can trace around the paper in a clockwise direction noting the calibration of the lines in ° West longitude. In a similar fashion, if the center of the paper is chosen to represent 90°N latitude (the north pole), successive concentric circles can be labeled as 80, 70, 60, 50, 40, 30, 20, 10 and finally 0° latitude (the equator). Turn the paper around so that 0° faces downward toward you and label the graph paper as shown in Fig. 2. These coordinates will be used to plot a reference orbital track. Once the labeling is completed, consult Table 2 which shows the satellite sub-point plotted

| Minutes After Equatorial Crossing | Latitude (°N) | Longitude (°W) |
|---|---|---|
| 0 | 0 | 0 |
| 2 | 6 | 2 |
| 4 | 12 | 3.5 |
| 6 | 18 | 5.5 |
| 8 | 24 | 8 |
| 10 | 30.5 | 10 |
| 12 | 37 | 13 |
| 14 | 42.5 | 15 |
| 16 | 49 | 18.5 |
| 18 | 54 | 22 |
| 20 | 60 | 27 |
| 22 | 65 | 32 |
| 24 | 71 | 44 |
| 26 | 76 | 62 |
| 28 | 78 | 86 |
| 30 | 78 | 115 |
| 32 | 75 | 140 |
| 34 | 70 | 154 |
| 36 | 65 | 164 |
| 38 | 59 | 170 |
| 40 | 53 | 174 |
| 42 | 47 | 178 |
| 44 | 41 | 181 |
| 46 | 35 | 183.5 |
| 48 | 28 | 186 |
| 50 | 22.5 | 188 |
| 52 | 16 | 190 |
| 54 | 11 | 192 |
| 56 | 5 | 193.5 |
| 58 | -2 | 195.5 |

*TABLE 2. Data for plotting the reference orbital track with intervals of 2 minutes. The track should be plotted on a piece of polar coordinate graph paper and then transferred to a clear acetate sheet.*

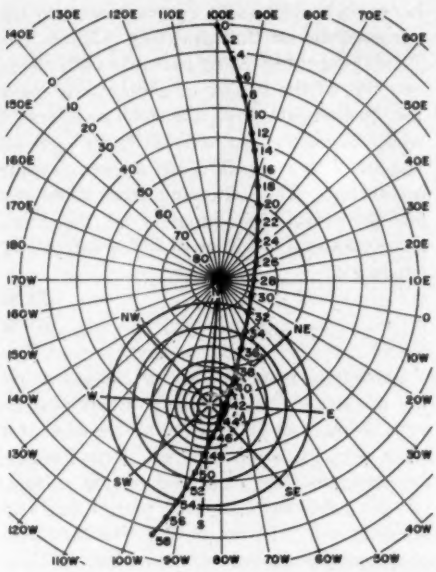


*Fig. 3. Station location (46°N, 85°W), antenna elevation circles, and antenna bearing lines with a superimposed orbital plot.*

at two minute intervals following an equatorial crossing. Using a pencil and consulting the graph calibrations, transfer the sub-point data in Table 2 to the graph. You should get a plot essentially identical to that of Fig. 2. When you are sure that all the data points are accurately placed, ink in the 2 minute points and the connecting track. Place a piece of clear acetate plastic over the sample plot and transfer the points and the track to the clear plastic sheet. Some small felt tip pens will work well for this step as will india ink. The ink should be indelible to prevent smearing. Before removing the plastic, mark the position of the graph center point. Put the acetate sheet aside until we are ready for a sample tracking exercise.

The next step is to prepare a "map" that will enable you to convert satellite position data to bearing and elevation figures for your antenna. If we view the polar coordinate paper as a map, the calibration of the paper is rather inconvenient for stations in the United States, primarily because US locations would fall on one side of the paper where the latitude circles do not extend all

the way to the equator. Examine your trusty globe and determine the nearest 10° increment of longitude to your location. In my case, since my QTH is located near 85°W, I chose 80° as the nearest point. Taking another piece of the polar coordinate paper, arbitrarily label the radial line directly facing downward with this value. Although my example is 80°W (used in the following example) yours is likely to be some other value. With that reference line established, label the remaining 10° increments of latitude from 0-180°W and from 0-180°E. The concentric circles of latitude are labeled the same way they were in Fig. 2. When you are finished you should have a layout similar to that of Fig. 3 except that it is "customized" for your location. Next, locate your position on this "map" and place a point there. This has been done for Fig. 3 (again, my location). Once your QTH has been located, the next step is to add a plot that can be converted to antenna elevation angle. The required antenna elevation angle for any given satellite is a function of the distance of the satellite sub-point and the altitude of the satellite in its orbit. Since the altitudes of the weather satellites and OSCAR satellites all cluster near 800 nautical miles because of the desired orbital geometry for weather satellite service, it is possible to calculate distances from the receiving stations that represent various antenna elevation angles. These data are summarized in Table 3 for an orbital altitude of 800 nautical miles. The distance here is plotted in degrees since this can be determined directly from the polar coordinates on the paper. Take a compass and with the point on the center of the paper (the pole), adjust it so the pencil point rests 36° out from the center. Transfer the point of the compass to the spot representing your QTH and use the compass to inscribe a circle with a radius of 36°. This circle represents the maximum satellite sub-point distance you could expect reception since it is equivalent to an antenna elevation of 0°. Using the data in Table 3 repeat the process with a series of smaller concentric circles. Fig. 3 shows circles representing 0, 10, 20, 30, 40, 50, 60 and 70° of antenna elevation. You can draw a circle for 80° if you wish, but it is quite small. At an antenna elevation of 90° the antenna is pointing straight up so the center point represents this elevation, which you will only use when the satellite passes directly overhead.

| Antenna Elevation Angle (°) | Great Circle Arc Distance (°) |
|---|---|
| 90 | 0 |
| 80 | 2 |
| 70 | 4 |
| 60 | 6 |
| 50 | 8.5 |
| 40 | 11.5 |
| 30 | 15.5 |
| 20 | 20 |
| 10 | 27 |
| 0 | 36 |

*TABLE 3. Antenna elevation angle as a function of great circle arc distance for a satellite in an 800 nautical mile orbit.*

The only thing that needs to be added to our map now is a series of lines to indicate antenna bearing or direction. Using a straight edge, draw a line from the pole, through your QTH and out the bottom of the largest (0°) circle. This is our north-south reference line. A line at right angles to this and passing through your QTH will be the east-west line. Two additional lines, each passing through the center, can be added for NE-SW and SE-NW. Your completed map should resemble that of Fig. 3 except that everything would be centered on your QTH. In addition to preparing your own map, you might wish to duplicate the one in Fig. 3 so you can follow the tracking example. For the purpose of Fig. 3 I located my QTH at 46°N and 85°W with 80°W representing the lower center radius.

Believe it or not we are now ready to use all of this "stuff" in an actual tracking exercise. The source for our data will be the satellite equatorial crossing data broadcast by W1AW. The W1AW bulletins include satellite crossings for both operational weather satellites and OSCAR satellites. Let's take a typical example. W1AW announces that NOAA 3 will cross the equator at 1500Z at 100°E. The equatorial crossings are always northbound – ie., the satellite leaves the southern hemisphere and enters the northern hemisphere – and our tracking times will be referenced to this

time. Take your map (for the sake of this discussion use the one you made that duplicates Fig. 3) and place the clear acetate sheet with our sample track over the map. Place a thumbtack through the center of the sheet *and* the center of the polar map. You should now be able to rotate the transparent overlay with the track about the center of the map. Rotate the acetate overlay until the 0 minute time point of the sample track is located on the equator at 100°E and you should have something that corresponds exactly to Fig. 3. You now have laying before you a complete representation of where the satellite is going to be in the first half of its orbit. Note that the satellite will progress steadily northward after its equatorial crossing and will pass east of the North Pole at approximately 28 minutes after its crossing time (1528Z). Also note that the earliest time that the satellite will pass within the 0° antenna elevation circle is approximately 32 minutes after equatorial crossing (1532Z).

There is no point in listening for the satellite before 1532Z for it will be below my horizon. Using the reference track as a guide, plot the direction and antenna elevation for each of the two minute positions during which the satellite is within range. You should get something like the data in Table 4. Note that the satellite will only be within range from 1532 until 1554Z. If you were to move the antenna to the positions indicated at the proper times you would — wonder of wonders! — be tracking the little devil.

| Time After Equatorial Crossing (min.) | Time G.M.T. | Antenna Elevation (°) | Antenna Bearing |
|---|---|---|---|
| 32 | 1532 | 0 | NNE |
| 34 | 1534 | 8 | NNE |
| 36 | 1536 | 17 | NNE |
| 38 | 1538 | 28 | NE |
| 40 | 1540 | 46 | NE |
| 42 | 1542 | 60 | E |
| 44 | 1544 | 60 | SE |
| 46 | 1546 | 41 | S |
| 48 | 1548 | 24 | S |
| 50 | 1550 | 14 | S |
| 52 | 1552 | 7 | SSE |

*TABLE 4. Example of antenna tracking data for a satellite equatorial crossing at 1500Z at 100°E from the quthors QTH. The plot in Fig. 3 was used to derive this data.*

Although the W1AW bulletins give at least three crossings for any given day, with any single crossing the crossings for the rest of the day can be determined if you know the orbital period of the satellite. Successive equatorial crossing times will be separated by the orbital period. Successive equatorial crossing locations will move westward along the equator due to the rotation of the earth beneath the satellite. The earth rotates 15° every 60 minutes (360° in 24 hours) or 0.25° per minute. Thus, 0.25° x the satellite orbital period in minutes will tell you how much further west the satellite will cross the equator the next time it arrives. In the case of NOAA 3, whose orbital period is 116.2 minutes, the next equatorial crossing would occur at 1656Z (1500 + 116 min.) at 71°W (116.2 x 0.25° = 29° which subtracted from 100°E gives 71°E). Table 5 shows representative crossing times and locations for the entire day derived from the single piece of data presented in the bulletin transmission.

If you use the Fig. 3 map, the orbital overlay, and the sample data in Table 5 you will be able to see how the day's passes relate to my station. The pass before the reference example (129°E) would cause the satellite to be above the horizon to the east but results would probably not be outstanding since it would barely reach 10° elevation. The reference pass has already been discussed. The pass after the reference pass would cause the satellite to come over to the northwest of the station and since it would get as high as 28° it would be easily received. The next pass (42°E) would be off to the north and quite low in the sky. Although the satellite might be audible throughout the afternoon as it just cuts the receiving circle (0° elevation) to the north, the next good pass would be at 1941 EST when the satellite crosses the equator at 45°W. Note that these evening passes, in contrast to those of the morning, are characterized the satellite moving from south to north. The satellite would first be audible approximately 8 minutes after the 1941 EST crossing and would drop out at approximately 27.5 minutes after the crossing. The 2137 EST pass at 74°W would be an excellent one while the next one (2233.4 EST 103°W) would be marginal. Once you feel you

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understand the use of the map and overlay, use your own map with the overlay and calculate tracking data for your own station using the crossing data in Table 5. When you can do this you are ready to take W1AW data for any satellite and generate tracking information. The reference track was made up on the basis of a 116 minute orbit and can be used with any of the operational weather satellites (ESSA8, NOAA 2, NOAA 3, etc.) as well as the OSCAR satellites that are launched "piggy back" with NOAA/ ITOS launches. Should an OSCAR satellite or a weather satellite package be launched that by mischance departs greatly from this track we can include a table in a future issue of 73 to permit you to make up a reference track to fit its orbital path as well as any other supplimentary data you might need.

Just a few final notes are in order. Reception from a satellite is only possible when the satellite is above your local horizon — that is, within the 0° elevation circle on your own local tracking map. Given clutter on the horizon, good results are usually obtainable only when the satellite is at least 5° above the horizon. DX work through an OSCAR satellite demands that the satellite be above the horizon at both stations. This occurs quite frequently within

| Crossing Time (E.S.T.) | Crossing Latitude |
|---|---|
| 0019.0 | 115W |
| 0215.2 | 144W |
| 0411.4 | 173W |
| 0607.6 | 158E |
| 0803.8 | 129E |
| *1000.0 | 100E |
| 1156.2 | 71E |
| 1352.4 | 42E |
| 1548.6 | 13E |
| 1744.8 | 16W |
| 1941.0 | 45W |
| 2137.2 | 74W |
| 2233.4 | 103W |

*TABLE 5. Equatorial crossing data for a single day calculated from the reference crossing of 1500Z at 100° E. The crossing time was converted to EST and preceeding and succeeding crossings were calculated on the basis of a 116.2 minute (1 hour 56.2 minute) orbital period for NOAA 3. With this orbital period the location of successive crossings will move westward 29° per orbit. The reference crossing data are marked with an asterisk.*

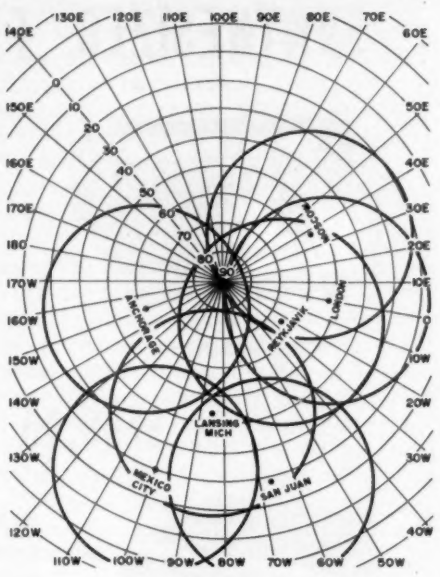
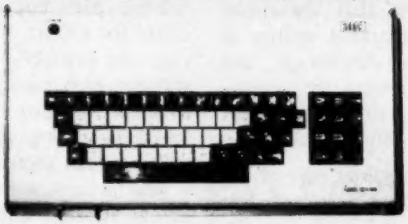



*Fig. 4. Polar projection with the author's QTH and several DX cities marked. Each location has a circle around it representing the distance corresponding to a 0° antenna elevation angle. Two requirements must be met for communication between any two points using a satellite repeater. First the zero elevation circles around the two points must overlap or communication is not possible. The greater the overlap the more opportunities there will be for a successful contact. Secondly, both stations must utilize a satellite pass that intersects the area of overlap between the two stations for it is only when the satellite sub-point is within the zone of overlap that it is above the horizon at both stations simultaneously. A little work with the orbital overlay will indicate what passes (in terms of equatorial crossing point) may be used and how long the satellite would be in the "overlap" zone. Since these circles represent zero elevation angle they are somewhat optimistic. Intersection of 5° circles would be more conservative but the zero elevation circles can be used with foresight and planning for specific contacts.*

the US and Canada but real long haul DX requires some planning. Fig. 4 is a duplicate of my tracking map but on this copy I have drawn in the maximum "reception circles" (0° elevation angles) for a number of cities in various DX localities. Only those locations with circles that intersect my own can be expected to produce satellite contacts through an OSCAR package. The greater the degree of overlap, the higher the satellite will

# ANNOUNCING



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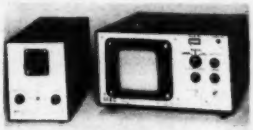

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be at both my location and that of the DX station and the longer the time available to establish a contact. Note that the circles around such widely separated points as Mexico City, San Juan, Anchorage, and Reykjavik comfortably overlap the acquisition circle around my own QTH and thus offer ready opportunity for communication between these points. The outer part of the circle around London intersects my own but this one would be tight. It would probably be best to calculate a specific pass where the satellite would intersect the area of overlap and arrange a schedule with an active London station. At best there would be a few minutes where communication was possible. The Moscow circle barely touches my own so communication with a station there would probably not be possible without a carefully arranged schedule, a little tropo bending, and some fast CW. The preparation of such a map would provide you with a realistic assessment of your OSCAR DX capabilities from your own QTH. Generally speaking, you should look for areas where the satellite is at least 10° high in both your own "sky" and that of the DX station – this is not only provides a realistic path but assures that ample time exists for a QSO. Where large overlap exists you can probably count on running into stations with random operating but as the overlap narrows you should consider schedules during specific passes if you are really serious about accumulating countries.

The information presented here should permit virtually any amateur to handle the task of satellite tracking. Should satellites be launched that do not fit the materials described here, 73 will provide updated materials as required. Although we have nicely sidestepped many aspects of spherical geometry and trig with a number of simplifying assumptions that would make a mathematical purist writhe in agony, the tracking procedure described here has one feature that transcends all those petty considerations – it works! You will get your antenna pointed in the right general direction at the right time which certainly beats swinging madly around trying to figure out where the satellite is and where its going next.

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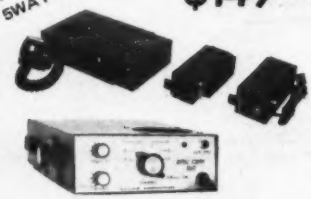

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# RTTY SECRETS UNVEILED

A recent "Junk Box TU" was constructed to provide a dependable unit expense. The basic unit makes use of tube type components in a configuration dictated by parts available in the junk box as the sole limitation. Using the "if ya have 'em use em" philosophy can be a real challenge in overcoming basic engineering problems. Several notes and surprises resulted from experimentation. To others of like inclination who feel that those beautiful military components may never be used, some experimental notes are presented.

## Relay Driver

It was found that a high voltage (not too high) transformer with full wave rectification would work very nicely in the HOFF Mainline Keying System, as shown in Fig. 1. The ±45V is established across the 50K linear pot. Higher voltages will require a larger value pot – experimentation achieves proper balance at the correct diode voltage.

## 6AL5 Detectors

Many of the older (and cheaper) TU designs call for a 6AL5 detector. Usually low output or imbalance problems result when using this type of detector to trigger an Eccles Jordan Bistable Vibrator. Switching to diodes in a doubler circuit gives outstanding results and reduces space and power requirements, see Fig. 2. One further advantage is that by grounding either point A or B and placing a small positive bias voltage to points A' or B' (equal to the diode dc output) "mark only" or "space only" copy is possible.

## Scope

Sure you like to see the cross pattern but 2API's, 902A's and like tubes are not as easily obtained anymore. There is, however, the mysterious 3API (which is anything *but*

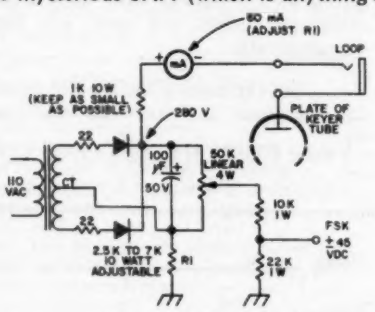



*Fig. 1. Relay driver.*

a three inch version of the 2API) still around in large quantities for a very small price. This CRT is rather long and skinny but works

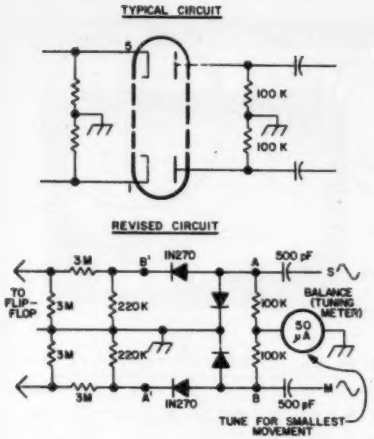



*Fig. 2. The top circuit shows the use of a 6AL5 detector. The revised circuit on the bottom uses diodes to accomplish the same purpose.*

very well with a few differences in scope design. The main difference is the filament supply which is 2.5VAC at 2.1. Transformers supplying this voltage are quite inexpensive if purchased new, and the center tap of a 6.3VAC supply can be pressed into service quite easily from the junk box to supply a slightly higher 3.1VAC for the 3API filament, as shown in Fig. 3. This higher voltage won't promote long life, but I've been using the same tube for over a year with no apparent weakening of emmission. The schematic in Fig. 4, shows the major values for the use of this tube and the pin connections and base diagram.

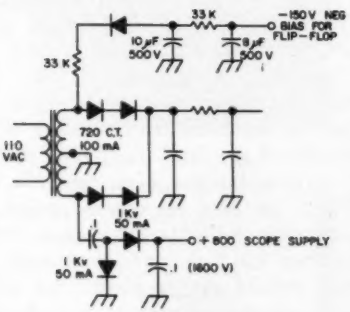



*Fig. 3. CRT power supply.*

No special shields are required if relative care is given to CRT positioning vs. stray magnetic fields.

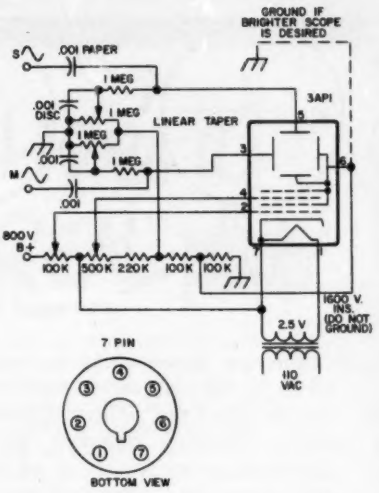



*Fig. 4. The scope circuit using the inexpensive 3API.*

## Scope Driver

Many RATT monitors make use of a scope driver, some with additional tuned circuits to "shapen up" the cross pattern. There are some who prefer blinking neons, others like wiggle needles, but I prefer the cross pattern because of a drifty receiver and I like to observe the level of QRN and QSB. After a time, one quickly learns if an S-3 RTTY QSO is "worth the paper" or whether or not power lines (close by) will destroy copy because of exceptionally high noise levels. The scope shows this quite well if it's not too sharp. Ideal patterns are of course the familiar cross. But more information can be evaluated if the band pass is slightly broad, see Fig. 5.

Most terminal units do not require sharply tuned coils because shifts vary and comparators can trigger sharply. Scope displays, however, show the composite signal, amplitude variation (by degree of deflection) and selectivity (the "off" tone "spills" into the displayed tone filter causing the line to spread into an elipse). One problem encountered, however, was the "lopped cross" or a cross that looked more like an "X." This was traced to a common cathode resistor in the scope driver circuits previously published. Separate them and the cross returns.

FAMILIAR CORRECTLY TUNED RTTY SHIFT ON SCOPE WITH GOOD BANDPASS INPUT CIRCUIT
WHAT MOST OF US GET THE FIRST TIME ON A HOME BREW SCOPE
GOOD COMPROMISE WHICH INDICATES NOISE AND QSB

*Fig. 5. Scope patterns.*

Another tip to the wise is wiring the scope B+ to the extra contacts on an auto-start relay. This cuts the "dot" during standby, and prevents premature phosphor burn. More sophisticated circuits can of course lower anode voltage (to a dimmer setting) in the absence of a signal.

### Transceiver Notes

RATT need not be so difficult especially in transceivers. In fact in some cases it's much simpler. In my transceiver, an old SR-160, only one FSK keyer is required. On 20m (USB only) the received upper side band appears as a preversed signal to the TU (but not on the air!). Because the i-f is common to 80, 40, and 20m, shifting takes place on the 5.2 MHz common oscillator. This guarantees that once set, the shift holds on all bands. When no voltage appears on the diode it still conducts slightly because of rf rectification thus lowering the frequency. Therefore, a holding bias provided in the Hoff circuit keeps everything steady. On receive, however, the diode bias must be *disconnected* or *permanently* applied to keep the receiver VFO (common to both transmitter and receiver) from shifting the receive frequency. Experiments with shift pot and polar relays, seriously compound the wiring problems and really are not worth the effort.

### Tuning Standards

Tuning toroids is easy if you follow the many procedures and outlines available in current publications, but for the casual RTTY buff, the tuning fork serves and saves money. Tuning forks are available from Federal Signal Co., at $5 a piece and may be used with a crystal calibrator/BFO combination in the receiver. So, don't rush out and buy a counter and an af generator to tune toroids.

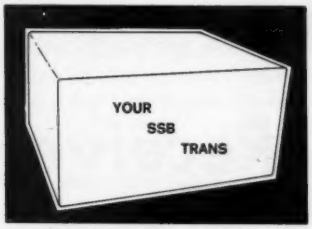
### Power Output

A very good fan can increase the duty cycle of a transceiver rated for peak service on instantaneous voice.

Most modern transceivers can not handle continuous loads for a great length of time. The sweep tube amplifier runs hot and thus forced air cooling increases the duty cycle. I have been operating RTTY at 90 watts input (rated 125 watts) with two 12DQ6s, for over a year with average key down times of 12 minutes on, 12 minutes off with no sign of soft tubes. SWR and antenna loading must be good, of course. In many cases the power output meter may not peak right at the plate current dip (in all parts of the band) but tuning up at the dip is the best procedure and provides the coolest operation. Neutralization adjustments on transceivers are a band compromise and should be set to the RTTY portions of the band.

Many of these notes will appear distasteful to the more discriminating RTTY enthusiast of the MLTT/L2, ST-6, and the WC1 variety. But for some, (and I've seen 'em) it's the best we can do under the circumstances. RTTY is really not so complicated once the basics are understood, and fiddling around with a home brew device often allows new concepts to be explored in detail. If you haven't joined the crowd yet, give it a whirl. And do it from the junk box until you learn the basics.

... W3JJU

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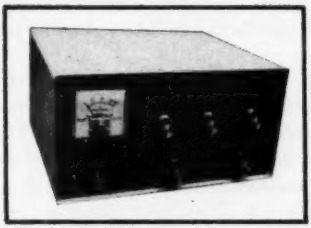

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# Miniboxing The 432er Receiver

The breadboard models of the 432'er work fine, the circuit is completed and sounds great on the air, components have been selected or fabricated, so it is now just a question of how small can the miniboxes be to package the whole job, what units to include in each box, and ease of construction by the homebrewer. Good flexibility and growth possibility should be retained, but this doesn't mean a box for every stage.

Figure 1 shows the block diagram of the third converter and the 135 kHz i-f strip. You could combine the 1.65 MHz i-f with the 135 kHz strip but as an experimenter I like to have a broadband i-f and diode on hand for all rf and antenna work. Because, as you will see when you operate one, even a good crystal local oscillator working in the UHF region will get thro .1 out of the narrow passband of the i-f with small changes in the mixer and rf stages.

Perhaps the 1.65 MHz section could be included in the tunable 28–30 MHz enclosure. We'll see. In the meantime let's tackle the last converter and 135 kHz i-f strip, which has the biggest components of the receiver.

Those very small Japanese units have an outside-threaded cup core that turns down over the i-f winding, which is on a separate tiny piece of powdered iron core. I think they are too small for practical work by the average amateur builder. The cores and windings used here seem to me about the limit on small size for now, with number 38 wire in them. The cup cores of old Miller number 10C i-f transformers originally made for tubes work almost like magic. The use of *two* sides of a single copper-clad board to fit things into a small minibox has worked out well. This makes for two layers of circuitry, but both are available from the outside of the minibox. Repairs or changes can be made easily, and you can also take it right out of the box with little work. See details below.

The average component density works out at about four stages in a 2 x 1½ in. box at present. So without jamming things too tightly and making construction difficult, each transistor and its associated components should fit into a space 2 x 1½ x ¾ in. And they do, as you will see.

While this model of the 432'er will not go into a camera case, it does look as though the old familiar pre-war transceiver case 12 in. high will hold everything nicely, including the battery.

Because it is really important that you know what you are undertaking with this kind of work, I will quote from the RCA "Transistor, Thyristor, and Diode Manual," page 582: "Circuits which work at UHF demand more than ordinary skill and experience in construction. Placement of component parts is quite critical and may require considerable experimentation. Unless the builder has had considerable experience with broadband high frequency circuits he should not undertake the construction of such units."

So there you are. It is my hope that by

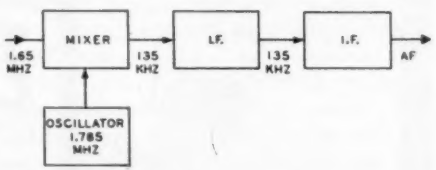



*Fig. 1. Block diagram of the converter and 135 kHz i-f stage.*

using my experience and by giving you all possible details, even outlining some of the troubles you can get into, that you will be able to build them.

RCA describes some nice circuits, parts of which are very useful and then says, "Home construction of this circuit should not be attempted unless the builder has had considerable experience in the winding of inductive components and has access to the special equipment required."

So we'll share our experience and give the real lowdown on the earthy details of winding and testing coils. Believe me, after 47 years (first license 2BAV in 1923) I still don't always get it right the first time.

**Tools for Miniboxing the 432'er.**

Let's face some of the facts of miniaturization. You're going to need a few things you may not have on hand, such as real small tools, .021 pins for binding posts, .035 figerglass boards, double-clad boards with copper on both sides, 1/8thW or 1/10thW resistors, and real small capacitors like the 3/16ths in. square ones in stock at Lafayette Radio. You will need either excellent young eyes or assisted older ones, like mine. I have a pair of glasses that magnify a little and focus at about 14 in. and a second pair that magnify about two times and focus at 9 in. I find these to be superior to any other type of magnifiers.

The most special tool after glasses is the

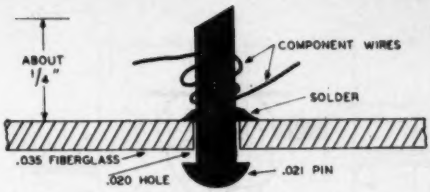



*Fig. 2. Sub-miniature terminal pins.*

jeweler's chuck for holding a number 76, .020 drill in a regular ¼ in. electric drill. Most of those little high-speed drills sold to hobbyists do not close tight on a number 76 drill.

I use a regular ¼ in. drill with a Variac to slow it down and clamp the small pieces of board in a drill vise. The number 76 drill comes in a little aluminum box with drill numbers from 61 to 80. You'll be well advised to buy at least a half dozen of the number 76.

The pins I use for terminal strips are called "bank pins" and are short, .021 in diameter and hammer into the .020 holes tightly. Tinned with solder and with wire around them, they will not come out (Fig. 2). If you know of any other low-cost method that is better, or smaller, please let me know.

Terminal strips can be made up as in Fig. 3, or in any other desired configuration. I generally use three pins for the transistor with one to the left for a base input coupling capacitor and one on the right with a bus

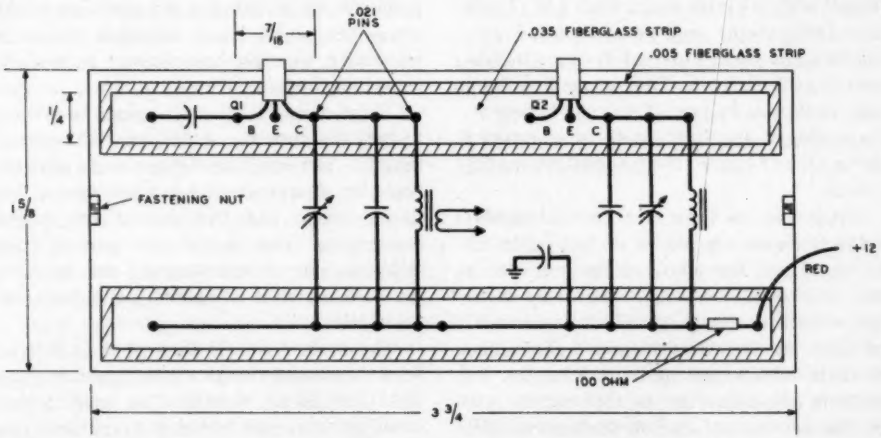



*Fig. 3. Terminal strip layouts.*

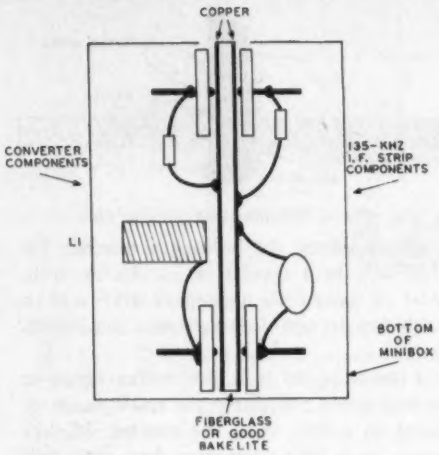



*Fig. 4. Two-layer boards.*

wire from the collector because the collector usually has at least three components attached to it. Cement in place for wiring. After wiring the components will hold it in place. Be sure to insulate the strip from the baseboard so the heads of the terminal pins don't short to the baseboard.

### Two Surfaces Instead of One Inside the Minibox

Several methods are in favor today to save space in enclosures, some going to the extreme of three layer printed circuits and flatpacks with 30 devices inside, with an OD of ¼ x 1/8 x 1/20 in. These are the little "bugs" with 14 leads each. With LSI (Large Scale Integration) they claim they are putting two and three hundred devices (transistors) in each flatpack. They are selling them now, so it must be true, if you can believe it. These are all for logic work in computers and as far as I know have no applications for rf work.

Along with the three layer printed circuitry the flatpacks are placed on both sides of the board and the whole thing goes into a tray with an OD of only .400 of an inch. This is outside the scope of amateur work, and calls for the "farthest out" chemicals, materials, metals, and methods of testing. As amateurs we cannot go to that extent just yet, but we can put a whole station on UHF complete with batteries into less than one cubic foot!

For the two layer job described here you can use a double-clad laminate which has copper on both sides, or you can bolt two single-sided boards together back to back as in Fig. 4. This has a tendency to fill up the minibox better, which, in military circles, is called "volume density." Believe it or not, the finished unit has some pretty large empty spaces in it.

### Low Frequency I-F Inductors

We have a good formula for these now, already used in the breadboard 432'er receiver i-f sections, which works well on the air, so that's the sort we will concentrate on.

The big question is whether to use variable inductance tuning or variable capacitance tuning. Most commercially available small and midget transformers use an outside threaded core which is then turned to provide a linear motion of the cup core to provide more, or less, cover over the winding, which increases or decreases the inductance. Some form of threading is used on the inside of the transformer can, but this is generally not usable for experimental work, as you can see if you take one apart.

For amateur use this whole question of i-f strip, or strips, because we're using triple conversion, is of considerable importance. The usual 455 kHz i-f jobs fall right between the frequencies we would like best for selectivity and image. The 135 kHz used here seems about as low in frequency as is practical for a low-cost i-f with good AM voice bandwidth, and furnishes excellent selectivity for the homebrewer as well as good image rejection.

Then your next i-f, going backward toward the antenna, should be – as a rule of thumb – not less than 10 nor more than 20 times in frequency, as a compromise between image and the use of too many conversions. This would put you at 1.35 MHz but you shouldn't really use an i-f in the bc band, so it is located just outside, on 1.65 MHz.

The next i-f should then be at 16.5 MHz, so we stretched things a little again and put it in the 28 to 30 MHz 10m band, which could get you into occasional trouble if you had a 10m kilowatt neighbor, but makes for a nice portable 10m receiver and is also one

of the popular i-f output frequencies for VHF and UHF converters which are on the market.

Then the rf head on 432 MHz has an image some 600 MHz away, which is fine. So there is the triple conversion and its frequency reasoning set out for you.

Meanwhile, back at the coilwinder, we are working with a little device that does the job very economically. Shown in Fig. 5 is a jig which will hold almost any coil form for i-f use. The spool of wire in use is set on the floor suspended on a ¼ in. dowel pushed through a cardboard box and the wire rolls off it nicely. Count the number of turns made around the coil for every turn of the crank. It will generally be around 4:1. This makes it easy to count the total number of wire turns on the form.

Several days were devoted to winding 135 kHz i-f conductors for the converter, the 1.785 kHz oscillator coil, and the 1.65 MHz i-f coils, tuning them up, and checking for gain and bandwidth. Coil winding data is shown at Fig. 10 (the final circuit).

A simplified jig for testing these coils is shown in Fig. 6. For test signals I used a Lafayette signal generator for the 1.65 and 1.785 MHz frequencies, and my sine wave-square wave generator for the 135 kHz. When ready to wind, a little coil wax melted onto the form helps to hold the wire in place. Put a little more over the first winding and a final touch of wax over the outer layer to hold everything in place in the core. I also melted a little down into the core. Figure 7 shows what the coil and core look like when ready to put together. Two cores are used. Insert the wound form into one core, and then put the other core over the part of the form that is outside the first core, taking care not to move or break the fine wires. Make sure that the coil form is just twice the length of one of the cores. After testing the core and coil assembly can be cemented in place on the circuit board.

Using a moving cup core for tuning was checked and dropped in favor of the mica compression trimmer, for mechanical reasons. If you are a master machinist (I am not) you could possibly turn out a plastic holder with the thread needed which is something like 11/16ths diameter and a 28

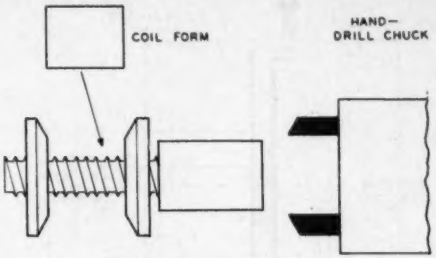



*Fig. 5. I-f winding aids.*

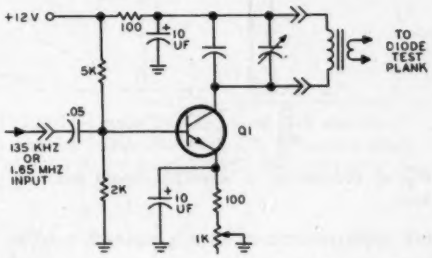



*Fig. 6. Test jig, i-f coils.*

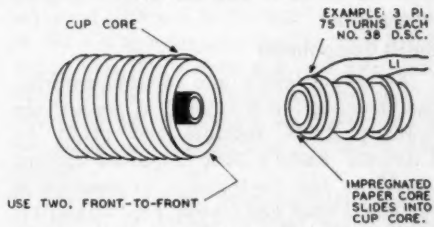



*Fig. 7. Cup core windings.*

thread. If not, be happy with the Arco trimmer No. 469 which varies from 130 pF to 800. Use a dipped mica where needed, as across L1 at 135 kHz, in case you don't quite reach 135 kHz.

The 1.785 MHz oscillator coil was checked in a similar jig using the actual oscillator circuit as in Fig. 10.

**Packaging Notes**

On the average, if you are ready to build something small in a minibox, and more or less permanent, it pays to have all the components checked first. At one time you could make changes after building something in a 10 x 12 x 3 in. chassis but it's not as easy now, when you are packaging in small miniboxes. However, the two-sided board in the middle of a minibox (Fig. 4) does give you good access to both working surfaces

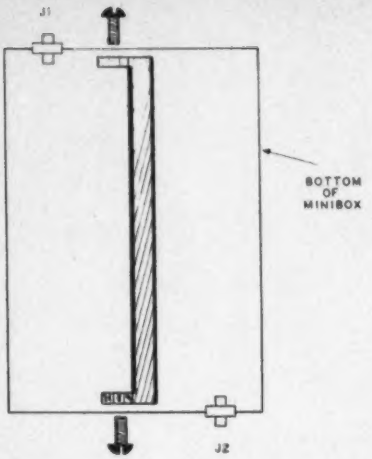



*Fig. 8. Illustration of assembly, board and minibox.*

for adjustment and tuning, and if you do have to make a change anywhere it is possible to do it without dismounting the whole plank.

**Small Components**

We're not going into microminiaturization here, just miniboxing, so we will use ordinary 1/8W resistors and profit by Lafayette Radio's little imported ceramic capacitors and electrolytics, as specified in the final circuit and layout, Figs. 10 and 11.

The Arco mica trimmers are rather large but there does not seem to be anything smaller available at a reasonable cost. The midget type 42 Arco trimmers are 3/8 wide x 3/4 long, with the number 4215 running from 210 pF to 700 maximum.

**Assembly**

I used brass nuts soldered to the baseboard to fasten it to the inside of the minibox as in Fig. 8.

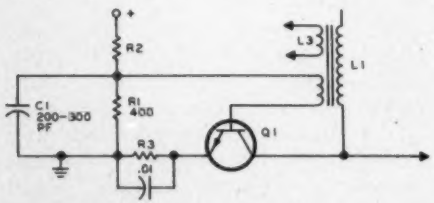



*Fig. 9. Schematic of the final oscillator circuit. C1 200–300 pF; C2 .01 μF; R1 400Ω.*

Fabricate the transistor terminal strip and the +12V bus strip (Fig. 3) and fasten them down either by cementing or by the use of extra pins and soldering to the baseboard.

The two sides of the double clad board can be treated as two completely separate assemblies, and tested separately also. Then a single wire from L2 on the last 1.65 MHz winding can go through a grommeted hole to the other side and be soldered to the mixer input.

The principle of a double i-f frequency with a conversion in the middle is an excellent one, allowing a lot more gain with freedom from feedback of the input to output variety. With the input on 1.65 MHz and the output on 135 kHz, none of the usual feedback possibilities are present.

**Oscillator Spurious**

Yes, once again, trouble in the 1.785 MHz oscillator. So we will try one thing at a time and check each carefully. First of all we should recognize that a modern device has easily over 40 dB power gain at 1–2 MHz. This means that one hundredth of a milliwatt at the input will result in 100 mW in the collector circuit which could result in a lot of feedback. So what cuts down gain? To cut it short, and save you time, the final oscillator circuit (Fig. 9) shows how the oscillator was tamed. The important items were found to be L2, C1, C2 and R1. L2 must be small, like 2 turns. C1 must be near 200 or 300 pF, no higher. C2 is all right at .01, and R1 should not be over 470Ω. The oscillator handles fine now, in fact so smooth I was bothered by news reports coming in from the "all nighters" around 1500 kHz as I was checking the range of 1–2 MHz for operation at 1.785 MHz. I was running an af amplifier and speaker after the diode and voltmeter, and the fact that the combination shown in Fig. 6 and the diode test plank result in an excellent one transistor regenerative set when R1 is lowered or L2 is decoupled to bring it out of the oscillating condition into the regenerating detector mode, brought in these bc stations. You may not realize it, but one of the criterions for a smooth oscillator is that it should do just that, with less than necessary feedback.

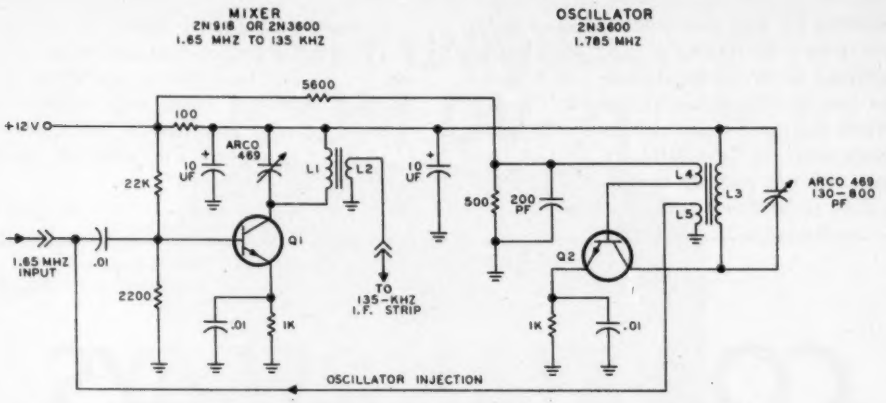



*Fig. 10. Schematic of the third converter and the 135 kHz i-f stage. L1, 225 turns. See also Fig. 7. Two cores used, front to front. L2, 15 turns wound over L1 (inside the core). L3, 25 turns in single core. L4, 2 turns over L3 (inside core). L5, 2 turns over L3 (inside core). NOTE. The coupling of L4 to L3 is important. Reverse wires of L4 if no oscillation.*

Just for a check, C1 and C2 were increased to 10 μF each, and heavy self-quenching at audio frequencies poured out of the speaker.

I spent another half-day on it to make sure of everything for you, as in Fig. 9. I would say it is by far the best oscillator I have ever built for the .5 to 5 MHz range, with lots of reserve power, stability and no trace of spurious radiation.

### Third Converter and Oscillator Circuit

Refer to Fig. 10, schematic, and Fig. 11, layout. This circuit works well in a closed minibox, using so far only one half the space available, with the two 135 kHz narrow-band stages and diodes going into the other half.

The mixer used was an RCA 2N3600, but any good NPN will do because in this section of the 432'er we're only dealing with 1 to 2 MHz. You don't need a lot of gain, you don't need hf capabilities, all you need is selectivity, smooth tuning, good avc, and the possibility of construction by the home-brewer.

Inductor details, terminal pins, and assembly, have all been detailed, so just check all values possible, and turn it on. Being an experimental type, I fed a 1.65 MHz signal into C1, tuned up the mixer collector coil to 135 kHz, connected a diode to the 15 turn

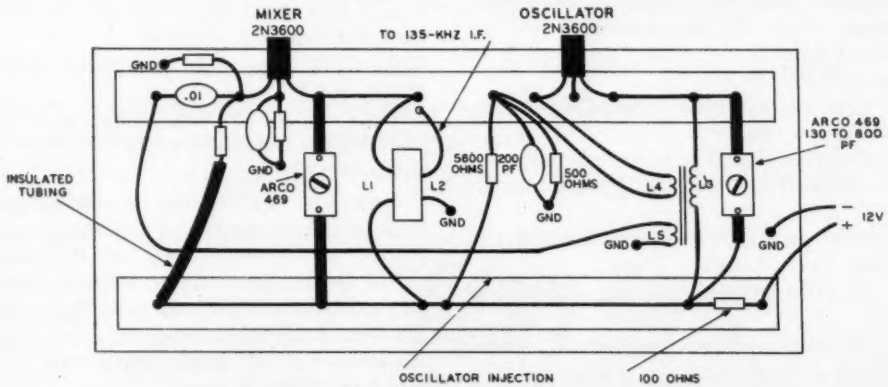



*Fig. 11. Layout, third converter and oscillator, 1.785 MHz.*

winding L2, and started in. As shown in Fig. 10 there is no tuning at 1.65 MHz (in this section) so the image at twice 135 kHz will be just as strong, but that doesn't matter. When the three tuned circuits of the broadband strip on 1.65 MHz are used in front you will not pick up the image. At least it will be so far down it won't bother you.

I found only about a tenth of a volt out of L2 in the mixer collector circuit, but that was enough to tune up on and listen for spurious radiation. When that winding is connected to the input base of the two-stage 135 kHz i-f strip you'll find plenty of signal at the af connector output.

...K1CLL

---

*c/o 73 Magazine*
*Peterborough NH 03458*

# COAXIAL RELAYS ON 432 MHz

When checking things over before the last attack of seasonal madness (a VHF Contest) I took the unprecedented step of making some measurements on the send-receive coaxial relays. The figures were measured at 432 MHz, but the 144 MHz numbers can be expected to be only ten times better, and ten times better than crummy is not very good. For the benefit of the nonboffins, the isolation is given in power into the receiver per hundred watts of transmitter power. Figures for everything matched and terminated – with my luck things would be mismatched in just the wrong direction, but that's more work to measure.

How much leakage, applied repeatedly, will harm a receiver?

Two watts will cook some antenna coils.

A transistor like the 2N5109 will take 25 mW.

The 417 or a 6CW4 will probably stand as much.

A WE-416 I had kept cooking at around 10 mW.

Crystal mixers, such as the 1N21E, can take 10 mW if the dc resistance is under 50Ω for the mixer circuit.

The 2N2857 or 2N3478 will take 5 mW safely.

Microwave transistors or the TI XMO5 will only stand about 1 mW.

The leakage power per hundred watts that I measured:

Dow-key (N connector, shorting type) Transmitter side (normal open) – (26 dB); Receiver side, shorting barrier – 1 μW (80 to 96 dB) (Varied).

MA 7524 (rated 3 GHz) – 0.1 μW (90 dB).

Thompson products (Meshna) stripline type, round can, N connectors – 25 μW.

Rotary type, BNC, 28V #501 147 – 1 mW.

BNC, D-K type 315 – 10 mW.

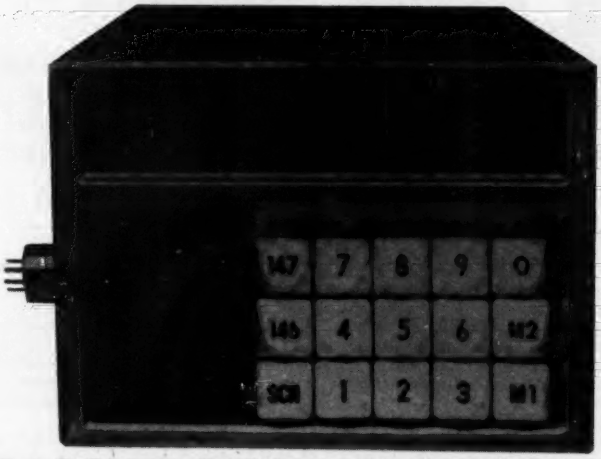
BNC, FXR type 318, terminating resistors – 10 mW.

Advance, N connectors, extra contacts (standard ten meter relay except for connectors) – 25 mW.

Note that the last one is still plenty adequate for protection of a nuvistor or a 2N5109 on 144 or 220 MHz in a matched coaxial system. The 2N5109, which is a two watt transistor, will give 3 dB noise figure on 220 MHz if the bias is set up for 2 to 3 mA (it's rated for 50). Maybe that's what we need for a reliable rf stage?

...W1OOP

# TRULY UNIQUE...
# ICOM DV-21

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WINTER 1975

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**SPECIAL SALES FOR THE HOBBYIST, AMATEUR AND BARGAIN HUNTER.**

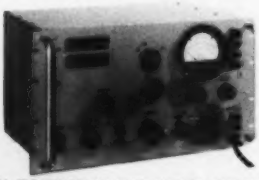
## INVENTORY REDUCTION SALE!!

(We must liquidate $100,000 worth of inventory during January and February at unheard of prices.)

Quantities are very limited on many items and will not likely be available again at the low prices.

The instruments listed are surplus unless otherwise stated. Each unit is sold as-is and every attempt is made to assure completeness. While most instruments are operational, no warrantee is implied or stated. There is a 10 day trial period for each instrument which allows you to inspect and assure yourself that you are satisfied. You may return the instrument for full credit during this 10 day period-paying only freight charges. Since it is impossible to list the individual condition of each instrument-call and discuss your choice. Should you desire the same instrument completely reconditioned and guaranteed, we can put you in touch with our parent company for price and availability information.

**CREDIT** - TECO'S terms are cash or COD with the following exceptions. TECO accepts BankAmericard, MasterCharge and American Express. TECO will sell on net 10 days to D&B or credit established customers. Our aim is to keep our overheads as low as possible so we can continue to offer instruments at the very lowest prices. Please help us to meet our goals and send your check with your order.



**MILITARY TS-723B/U (HP 330B) DISTORTION ANALYZER**

This marvelous noise and distortion analyzer gives accurate direct readings from 20 Hz to 20 KHz. Perfect for measuring audio distortion, voltage level, power output, gain, distortion of AM RF carrier, measuring hum and noise level and audio signal frequency. Blanketing the audio spectrum the TS-723 measures noise levels as small as 100μV and distortion as low as 0.1%. A wide-band 20dB gain amplifier is built in as well as a VTVM with nine full scale ranges from 0.03 to 300 volts and nine dB ranges spaced exactly 10dB per range from −12dB to +2dB. Residual frequencies are measured to within ±3% of full scale value. TECO'S special sale price is only ..... **$125.00**

**LEEDS & NORTHRUP 5430 A (MILITARY ZM-4B/U) RESISTANCE BRIDGE.**

This advertised special is a portable, general purpose wheatstone bridge designed primarily to measure resistances when locating faults which occur in conductors used for communications systems and those used for power transmission. It can also measure the value of any fixed resistor. In addition to the self-contained galvanometer it has provision for external null indicator and batteries. Measures resistance values from 0.001 to 1,011,000 ohms, internal battery power supply. Ratio dial multiplying values for resistance measurements and Varley loop tests are 1/1000, 1/100, 1/10, 1/9, 1/4, 1, 10 and 100. Ratio for Murray loop tests are M1000, M100 and M10. Accuracy is ±0.1% of indicated resistance ..... **$75.00**

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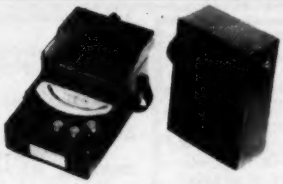

**GENERAL ELECTRIC PORTABLE METERS** include snap-on self contained cover, carrying handle and 0.5% DC accuracy. These excellent instruments are priced to move quickly so get your order in today.

SINGLE RANGE UNITS ..... **$15.00 each**
MULTIPLE RANGE UNITS ..... **$20.00 each**

**AC Ranges in Stock:**
0 to 0.75/1.5 KW; 0 to 1.5/3 KW; 0-300/600W; 0-10A; 0 to 15/30A; 0 to 30/60A; 0 to 10/20V; 0 to 15/30V; 0 to 25/150V; 0 to 150V; 0 to 150/300V.

**DC Ranges in Stock:**
0 to 50μA; 0 to 300μA; 0 to 500μA; 0 to 1 mA; 0 to 7.5 mA; 0 to 15 mA; 0 to 300 mA; 0 to 3A; 0 to 30A; 0 to 3V; 0 to 7.5/30/75V; 0 to 3/15/150V; 0 to 150V; 0 to 150/300V; 0 to 150/300/750V; 0 to 300V; 0 to 600V; 0 to 750V.

## METERS OF ALL TYPES

**ASSOCIATED RESEARCH 213 VIBROGROUND MEGOHMMETER:** With variety of megohm ranges ..... **$75.00**

**ASSOCIATED RESEARCH 259 VIBROGROUND:** Similar to Model 293 ..... **$65.00**

**ASSOCIATED RESEARCH 293 VIBROGROUND:** Lightweight instrument for measurement of soil-resistance and ground resistance. 0-1/10/100/1000 ohms. ..... **$80.00**

**BALLANTINE 300 VTVM:** 1 mV to 100V, 10 Hz to 150 KHz ..... **$25.00**

**BALLANTINE 305 PEAK READING VTVM:** Measures P-P, positive or negative peak values, 5 Hz to 500 KHz response 1 mV to 1000V with mirror back scale ..... **$95.00**

**BALLANTINE 310A VTVM:** 100 μv to 100V. Measurements from 10 Hz to 2 MHz. 3% accuracy to 1 MHz. ..... **$75.00**

**BALLANTINE 310AR VTVM:** 100 μV to 100 Volts. 10 Hz to 2 MHz ..... **$65.00**

**BALLANTINE 314 VTVM:** 1 mV to 1KV, 15 Hz to 6 MHz, less probe ..... **$75.00**

**BALLANTINE 316R VTVM:** Peak to peak. 0.05 Hz to 30 KHz ..... **$35.00**

**BIRD 6150 WATTMETER:** Direct reading 0-30/150 watt ranges, 30 to 500 MHz range. 50Ω .... **$95.00**

**BIRD 61S4 WATTMETER:** Direct reading 20 or 5 watts (choice), 50Ω, N(F) connector, includes meter **$65.00**

**BIRD 67 WATTMETER:** Direct reading 0 to 25/100/500W ranges, 50Ω, QC connector, 30 to 500 MHz range ..... **$150.00**

**BIRD 694 WATTMETER:** 0 to 1000W direct reading, 2 to 36 MHz, 50Ω, N(F) connector ..... **$195.00**

**BOONTON 91CR RF VTVM:** 1 mV to 3V, 20 KHz to 1.2 GHz, rackmount ..... **$225.00**

**BORG WARNER (SINGER) M401 SWR INDICATOR:** ..... **$95.00**

**CARY MODEL 31 VIBRATING REED ELECTROMETER:** 1 mV to 30V in 10 ranges ..... **$50.00**

**E-H RESEARCH 140A SWITCHING TIME METER:** ..... **$50.00**

**FLUKE 821AR DC DIFFERENTIAL VOLTMETER:** 0 to 500V, 0.01% ..... **$195.00**

**FLUKE 910A TRUE RMS VOLTMETER:** 10 Hz to 7 MHz, 100μV to 300V fs. ±1% accuracy ....**$225.00**

**FXR B810A SWR METER:** ..... **$35.00**

**FXR B813A POWER METER AND MOUNT:** .. **$35.00**

**GENERAL MICROWAVE 451 POWER METER:** **$35.00**

**GR 1800 VTVM:** 0.1 to 150V full scale. DC-800 MHz. 2% ..... **$50.00**

**GR 1803A AC VTVM:** 1.5V to 150V ..... **$50.00**

**GR 1932A DISTORTION METER:** 50 Hz - 18 KHz, ..... **$125.00**

**HP H18-340B NOISE FIGURE METER:** Automatic display and measurement of IF or RF amplifier noise at 30 and 60 MHz. Operates with external noise sources for other bands ..... **$400.00**

**HP 400DR VTVM:** 10 Hz to 4 MHz, 1 mV to 300V. 2% accuracy ..... **$65.00**

**HP 400HR VTVM:** 10 Hz to 4 MHz, 1 mV to 300V. 1% accuracy ..... **$95.00**

**HP 410BR VTVM:** Rackmount unit 0-1000VDC, 0.2Ω to 500 megohms, 0-300VAC, 20 Hz to 700 MHz ±3% fs ..... **$95.00**

**HP 412A DC VTVM:** 1 mV to 1 KV, 1 microamp to 1A, can be used as DC amplifier, 2% accuracy. .**$195.00**

**HP 415A VSWR INDICATOR:** ..... **$25.00**

**HP 416A RATIOMETER:** Displays ratio of forward and reverse signals automatically ..... **$125.00**

**HP 416B RATIOMETER:** Later version of 416A.**$395.00**

**HP 428A CLIP-ON DC MILLIAMMETER:** 3 mA to 1A ±3% probe included ..... **$250.00**

**HP 500C TACHOMETRY:** 180 RPM to 6,000,000 RPM. ..... **$85.00**

**ITE (PHAZOR) 100A PHASE SENSITIVE NULL METER:** 30 Hz to 10 KHz, 8 volts to 120V reference. Separates in-phase and quadrature null voltages, 40 dB selectivity ..... **$95.00**

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**MARCONI TF-928 FM DEVIATION METER:** 20-100 MHz, 0-12 KHz modulation, crystal standardized ..... **$55.00**

**MB MFG. CO. M1 VIBRATION METER:** ..... **$50.00**

**MB MFG. CO. M3 VIBRATION METER:** ..... **$50.00**

**ORION V-100M VTVM:** Similar to HP 400H, like new ..... **$60.00**

**NARDA MODEL 440 SOLID STATE MICROWAVE POWER METER:** Rechargeable batteries .. **$95.00**

**PRD 277B STANDING WAVE INDICATOR:** .. **$75.00**

**PRD 650 POWER METER:** ..... **$40.00**

**SIMPSON 604 RECORDING VOM:** New units .**$145.00**

**SIMPSON 605 RECORDING VOM:** New units .**$160.00**

**SRI AEW EDGESCALE METER:** 0 to 50/100/200 VDC ranges, 7" scale, 0.5% ..... **$25.00**

**SRI AEW EDGESCALE METER:** 0-250 VDC range, 7" scale, 0.5% ..... **$20.00**

**SRI CEW-7 EDGESCALE METER:** 0 to 200 VDC, 7" scale, 0.5% ..... **$20.00**

**SRI JW-4A EDGESCALE METER:** 0 to 1.5/6 mVDC ranges, 4" scale, 0.5% ..... **$30.00**

**SRI JW-4A EDGESCALE METER:** 0 to 150 mVDC range, 4" scale, 0.5% ..... **$20.00**

**SRI JW-4A EDGESCALE METER:** 0 to 150 mADC range, ½" scale, 0.5% ..... **$20.00**

**TRIO LABS VTVM:** AC-DC Model 1mV to 300VAC, 3mV to 300VDC ..... **$85.00**

**TRIO LABS 901-1 DC VTVM:** 3mV to 300 volts in 11 ranges ..... **$40.00**

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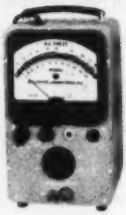

**BALLANTINE 300H VTVM:** The 300H is a compact, conservatively designed instrument for applications where high accuracy, low maintenance cost, long life, freedom from power line disturbances and simplicity of operation are of prime importance. Its basic accuracy of 2% of reading combined with calibration stability of 5000hours and high sensitivity of 30μV in the null detector mode makes the 300H a versatile laboratory tool. It is also usable as a 40dB gain wide band amplifier. Voltage range is 300μV to 300V with frequency range from 10 Hz to 1 MHz, input impedance of 2MΩ shunted by 15 or 25 pF and −10 to +10 linear dB scale ..... **$130.00**

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**GENERAL MICROWAVE 550 WWV RECEIVER:** ..... **$125.00**

**HAMMARLUND SP600 RECEIVER:** 560 KHz to 54 MHz. ..... **$225.00**

**MILITARY URM-7 RFI MEASURING SET:** Measures boradband and CW interference. Frequency range is 20-400 MHz in two bands. Voltage range is 6μV to 5V/MHz. Contains an impulse generator for noise reference standard. ±10% voltage accuracy ..... **$995.00**

**NEMS-CLARKE 1401 TELEMETRY RECEIVER:** 215 to 260 MHz range, similar to 1400 except later model ..... **$95.00**

**NEMS-CLARKE 1412 RECEIVER:** 215-260 MHz, crystal controlled with deviation meter. 100/500 IF bandwidth ..... **$75.00**

**NEMS-CLARKE 1432 TELEMETRY RECEIVER:** 215 to 260 MHz range, identical to 1412 except uses phase lock detector ..... **$75.00**

**NEMS-CLARKE 1455 RECEIVER:** 215-260 MHz, crystal controlled or internal VFO, 150/300 IF bandwidth ..... **$125.00**

**POLARAD R RECEIVER BASIC UNIT:** Nine plug-ins cover 400-84,200 MHz range. AM, CW, FM, MCW or pulse reception. IF bandwidth 3 MHz, video bandwidth 2 MHz, sensitivity −50 to −90 dBm. Requires plug-in to operate ..... **$350.00**

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**STODDART NM-50A RFI RECEIVER:** 375-1000MHz receiver, excellent units ..... **$595.00**

**BALLANTINE 300 VTVM:** The model 300 is a sensitive, wide band VTVM with a 100,000 to 1 voltage range and accuracy of better than 2% anywhere on the scale and at any frequency from 10 Hz to 150 KHz. Specific ranges allow measurement from 1mV to 100V with an input impedance of 0.5MΩ shunted by 30pF. The voltage ranges are logarithmic and there is a matching 0 to 20 dB linear decibel scale.

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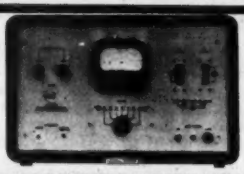
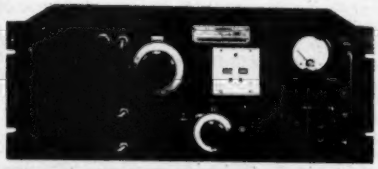


**HP 434A CALORIMETRIC POWER METER:** Just connect to the Type "N" input and read the power from 10 mW to 10 watts anywhere in the frequency range from DC to 12.4 GHz. No external terminations or detectors - readings directly in watts or dBW. 50 ohms input with internal calibrator circuit and ±5% accuracy. (Accuracy at low end of frequency range is as good as 0.5%). New price exceeds $2000.00.
TECO PRICE ..... **$695.00**



**MILITARY TS-537/TSM CRYSTAL IMPEDANCE METER.**
With a frequency range from 75 to 1100 KHz in 6 ranges and measurement scales from 0 to 99,000Ω and 12 to 110 nanofarads this portable, general purpose, test instrument is designed to measure equivalent electrical parameters of quartz crystals of the type used for communications purposes. Provision is made to measure directly the effective series-resonant and anti-resonant resistances of a piezo-electric quartz crystal in its holder. The load capacitance is obtained by applying dial markings to a calibration chart. With the static capacity measured by an external capacity measuring device and with the series-resonant and anti-resonant frequency measured by an external frequency measuring device, the series capacitance and inductance can be calculated. A microammeter indicates the magnitude of oscillation of the oscillator tube by measuring its grid current. Frequency is selected by a switch and a fine tuning control. Equipment can be bench or rack-mounted ..... **$55.00**

**MILITARY AN/UPM-33 RADAR TEST SET & ANALYZER.**
A general purpose test set designed for depot testing of the overall system performance of a radar system. It will check frequency of signal generators, local oscillators, magnetrons, T/R and R/T boxes. It will measure pulsewidth, RF spectrum width and the Q of resonant cavities. Built in 3" CRT screen, direct frequency readout. Also known as TS-148/UP Spectrum Analyzer. Frequency range from 8470 to 9630 MHz. Tube complement includes (3) 6SJ7, (1) 6SA7, (3) 6SN7GT, (1) 6AC7, (1) 3BP1, (1) 884, (1) 2X2A, (1) 5R4GY, (1) 6Y6G, (4) 991, (1) 2K25 and (1) 1N23B crystal rectifier. Supplied less accessories. An excellent value for the parts alone ..... **0.00**

**MEASUREMENTS MODEL 95 (MILITARY VERSION SG-3) STANDARD FM SIGNAL GENERATOR.**
A super buy. Perfect for the Ham using the 220 MHz, 2 or 6 meter bands. Frequency range is 50 to 400 MHz in three bands and a ±0.5% direct reading dial. Output voltage is continuously variable from 0.1 to 100,000μV into 50Ω. The many features in these excellent condition instruments make this the TECO buy of the quarter ..... **$375.00**

**TEXTRONIX 105 SQUARE-WAVE GENERATOR:** From 25 Hz to 1 MHz and with a risetime of less than 20nsec into a terminated 93 ohm cable - the 105 will generate up to 15V and more than 15mA peak-to-peak. Precision square waves over the complete range make the 105 a perfect instrument for testing amplifiers and other test instruments. The TECO price makes it even better ..... **$75.00**

**DID YOU EVER need a scope, meter or power supply, but really didn't need it all calibrated and checked out? Well, TECO understands and saves you more money than you could believe at the same time. TECO is just the place to pick up that extra counter or generator . . . or for that matter anything from a vacuum pump to a TV monitor. AND THERE'S ONLY ONE PRICE AT TECO - CHEAP.**

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# ANALYZER'S AND TEST SETS

**ACTON 328A PRECISION PHASE METER:** Solid state units with ranges of 0-60, 120, 180, 240, and 360 ..... **$95.00**

**AD-YU 405 PRECISION PHASE METER:** 1 Hz to 500 KHz, direct indication of phase angle in degrees, ±1 degree accuracy ..... **$125.00**

**BUDENBERG 280H DEADWEIGHT TESTER:** Hydraulic with range of 10 to 8000 PSID. Pistons are 1/8 and 1/80 square inch in area. Automatic changeover from low to high range. Accuracy to ±0.025% ..... **$395.00**

**BUDENBERG 283 DEADWEIGHT TESTER:** Hydraulic with range of 2000 to 50,000 PSID. Motorized unit incorporating an overhang piston head on a 0.005 square inch piston unit. Accuracy ±0.05%, some weights ..... **$795.00**

**DAVEN 10B TRANSMISSION MEASURING SET:** ..... **$295.00**

**DAVEN 12B TRANSMISSION SET:** ..... **$495.00**

**D&R FL-4 FLUTTER METER:** Percent deviation and percent flutter meter. Scope readout. Flutter bandwidth in four ranges from 0.5 to 30 Hz, 30 to 300 Hz, 300 to 5000 Hz and DC to 5 KHz. ..... **$250.00**

**DONNER 2102 WAVE ANALYZER:** 0-50 KHz unit **$395.00**

**HP (BOONTON) 255A FILM GAGE:** Used to measure film thickness such as anodized aluminum, gold plate, etc ..... **$295.00**

**HP (BOONTON) 275A TRANSISTOR TEST SET:** Precise measurements of basic transistor parameters plus characteristics of diodes and other semiconductors ..... **$295.00**

**HP 623B TEST SET WITH MILITARY KLYSTRON:** 7175 to 7725 MHz range ..... **$395.00**

**HP 739AR FREQUENCY RESPONSE TEST SET:** Provides measurement from 300 KHz to 10 MHz ..... **$250.00**

**HICKOK 123A AUTOMATIC TUBE TESTER:** Roll chart unit performs over 1500 tube tests .... **$125.00**

**HICKOK 850 TRANSISTOR ANALYZER:** In-circuit tester has six circuit configurations, tests NPN OR PNP ..... **$75.00**

**HICKOK 1890M TRANSISTOR TESTER:** Measures in-circuit Beta and Rin of transistors and leakage of out-of-circuit transistors. ±5% Beta measurement accuracy ..... **$75.00**

**MEASUREMENT 505 TRANSISTOR TESTER:** **$25.00**

**MILITARY UPM-6B Radar Test Set:** For deck testing of Mark VIFF equipment ..... **$65.00**

**MILITARY UPM-12 SWR INDICATOR TEST SET:** Used to make impedance measurements in X-band waveguide equipment ..... **$150.00**

**MILITARY UPM-17 SPECTRUM ANALYZER:** Military version of Lavoie LA-18M, general purpose spectrum analyzer covers 10MHz to 16 GHz. .... **$595.00**

**MILITARY UPM-33 SPECTRUM ANALYZER:** 8470 to 9630 MHz range. 10-30 Hz sweep, 50 KHz IF bandwidth, 80db sensitivity ..... **$50.00**

**PANORAMIC LP-1A SONIC SPECTRUM ANALYZER:** 20Hz to 22.5 KHz, quick-look wide range log scan, calibrated CRT, high resolution, many features ..... **$450.00**

**POLARAD K100 KLYSTRON TUBE TESTER:** **$100.00**

**POLARAD PJ-1 PULSE JITTER TESTER:** .... **$125.00**

**POLARAD TSA SPECTRUM ANALYZER MAINFRAME:** Resolution 2-80 KHz, dispersion 400 KHz to 25 MHz, sensitivity −50 to −95 dbm, variable attenuator, built-in marker. Other plug-ins available to 44 GHz ..... **From $150.00**

**SINGER SSB-3B SINGLE SIDEBAND SPECTRUM ANALYZER:** A comprehensive communications system analyzer with five preset and one continuously variable sweep widths, 2μv sensitivity switch selectable 50 or 600 ohm input impedance and resolution variable from 10 Hz to 3 KHz. Internal markers and many features ..... **$1295.00**

**SINGER (TELESIGNAL) TA216B TEST SET:** Includes interconnecting cable ..... **$155.00**

**SPRAGUE TCA-1 CAPACITOR ANALYZER:** .. **$50.00**

**STELMA TDA-2 RTTY DISTORTION TEST SET:** **$20.00**

**VIDAR 720 FLUTTER ANALYZER:** Seven operating frequencies from 3.125 KHz to 200 KHz, flutter bandwidth from 312 Hz to 10 KHz. Built-in scope, solid state unit ..... **$350.00**

# FREQUENCY MEASURING EQUIPMENT

**BECKMAN 7570 CONVERTER MAINFRAME:** Accepts 7570 series converter plug-ins to expand basic range of counters using heterodyne technique ..... **$35.00**

**BECKMAN 7571 PLUG-IN CONVERTER:** 10 MHz to 110 MHz ..... **$25.00**

**CMC 786C DUAL PRESET COUNTER:** ..... **$95.00**

**GERTSCH FM-3 FREQUENCY METER:** Measures 20-1000 MHz with 0.001% accuracy, generates over same frequency ..... **$195.00**

**GERTSCH FM-4 FREQUENCY MULTIPLIER:** Measures and generates signals from 500 MHz to 12.5 GHz, requires 400-1000 MHz driving source ..... **$295.00**

**GERTSCH FM-6 FREQUENCY METER:** Measures and generates frequencies from 20 to 1000 MHz with 0.001% accuracy ..... **$695.00**

**GERTSCH FM-7/DM-3 FREQUENCY METER:** Includes deviation meter, measures and generates signals from 20-1000 MHz with 0.001% accuracy ..... **$795.00**

**HP 524B COUNTER:** DC to 10 MHz, 6 digit neon, 2 meters ..... **$95.00**

**HP 524C COUNTER:** DC to 10 MHz, 8 digit nixie **$195.00**

**HP 524D COUNTER:** DC to 10 MHz, 8 digit neon. **$145.00**

**HP 525B CONVERTER PLUG-IN:** 110 MHz to 220 MHz ..... **$75.00**

**NORTHEASTERN 14-22C CONVERTER PLUG-IN:** Same as HP 525B ..... **$50.00**

**NORTHEASTERN MODEL OF 525C CONVERTER PLUG-IN:** ..... **$150.00**

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# SIGNAL GENERATOR

**ALFRED 620B SWEEP OSCILLATOR:** 0.5 to 1.0GHz, N output at 10mWatts ..... **$395.00**

**ALFRED 622BK SWEEP GENERATOR:** Complete unit covers 2-4 GHz range ..... **$395.00**

**ALFRED 623B SWEEP GENERATOR:** Complete sweeper covers 4-8 GHz range ..... **$395.00**

**ALFRED 624B SWEEP GENERATOR:** Complete sweeper for 8-12.4 GHz range ..... **$395.00**

**ALFRED 625B SWEEP GENERATOR:** Complete unit covers 12.4 to 18.0 GHz ..... **$395.00**

**ALFRED 642K SWEEP GENERATOR:** Complete 2-4 GHz unit ..... **$795.00**

**DATAPULSE MODEL 103M PULSE GENERATOR:** 10Hz to 5MHz, vari width 0.02 to 100μsec, 95 volt output ..... **$125.00**

**DUMONT 404 PULSE GENERATOR:** 1-100 KHz rep rate, 0.02 to 100μsec pulsewidth, 3V into 600 ohms, 0-50dB attenuator ..... **$65.00**

**EH 120D PULSE GENERATOR:** 100Hz to 20MHz, 20V into 50Ω, 1.3ns rise at 20V, variable pw, dual pulse ..... **$595.00**

**EH 121 PULSE GENERATOR:** 10Hz to 10MHz, 4ns rise ±50V into 50Ω. Variable width with fixed 120ns delay ..... **$695.00**

**FXR L771A TEST OSCILLATOR:** 950 to 2000 MHz, good buy ..... **$175.00**

**FXR S771B TEST OSCILLATOR:** 1.9 - 4.0 GHz. **$175.00**

**FXR G772A SIGNAL GENERATOR:** 3.95 to 8.2 GHz, 10-100mW output, internal square wave modulation, external pulse and FM ..... **$195.00**

**FXR X772A SIGNAL GENERATOR:** 7-11 GHz, similar to G772A ..... **$395.00**

**GENERAL MICROWAVE 301 POWER SUPPLY:** Powers GMC noise generators in 501 series **$20.00**

**GR 605B STANDARD SIGNAL GENERATOR:** 9.5 KHz to 30 MHz ..... **$100.00**

**GR 1201B UNIT POWER SUPPLY:** Powers 1200 series GR oscillators ..... **$35.00**

**GR 1208B UNIT OSCILLATOR:** 65 to 500 MHz, requires unit power supply ..... **$80.00**

**GR 1215B UNIT OSCILLATOR:** 50 to 250 MHz, requires unit power supply ..... **$95.00**

**GR 1211B UNIT OSCILLATOR:** 0.5 to 50 MHz, requires unit power supply ..... **$95.00**

**GR 1218A UNIT OSCILLATOR:** 900 MHz to 2 GHz, requires unit power supply ..... **$125.00**

**GR 1390A RANDOM NOISE GENERATOR:** 30 Hz - 5 MHz, 1V output ..... **$95.00**

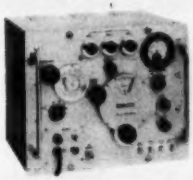
**HP (BOONTON) 203B UNIVERTER:** Used with 202 or 240 series generators to expand frequency to 100KHz - 25 MHz band ..... **$50.00**

**HP 205AG AUDIO OSCILLATOR:** 20 Hz to 20 KHz. ..... **$250.00**

**HP 205AH HIGH POWER OSCILLATOR:** 20 Hz to 20 KHz 5 watts output into 50, 200, 600, or 5000Ω. Built-in attenuators, input and output meters. **$275.00**

**HP (BOONTON) 207E UNIVERTER:** Extends range of 202 series generator ..... **$125.00**

**HP (BOONTON) 207B UNIVERTER:** Extends range of 202 series generators ..... **$95.00**



**HP 616A SIGNAL GENERATOR:** Direct reading and direct control from 1.8 to 4.2 GHz. The HP 616A features ±1.5dB calibrated output accuracy from −7dBm to −127dBm. The output is directly calibrated in microvolts and dBm with continuous monitoring. Simple operation, frequency dial accuracy is ±1% and stability exceeds 0.005%/°C change in ambient temperature. Calibrated attenuator is within ±1.5dB over entire output band. 50 ohm impedance unit has internal pulse modulation with rep rate variable from 40 Hz to 4 KHz, variable pulsewidth (1 to 10μsec) and variable pulse delay (3 to 300μsec). External modulating inputs increase versatility. New price exceeds $2000.00. TECO PRICE ..... **$395.00**

**HP (BOONTON) 207D UNIVERTER:** Extends range of 202 series generators ..... **$125.00**

**HP (BOONTON) 207G UNIVERTER:** Extends range of 202 series generators ..... **$175.00**

**HP 212AR PULSE GENERATOR:** 60 Hz to 5 KHz **$65.00**

**HP 218A/219B DIGITAL DELAY GENERATOR WITH DUAL PULSE PLUG-IN:** Superb units have many features. ..... **$375.00**

**HP (BOONTON) 230A POWER AMPLIFIER:** 10MHz to 500 MHz in 6 bands. 4.5 watts output, up to 15V output into 50Ω ..... **$595.00**

**HP 233A CARRIER TEST OSCILLATOR:** 50 Hz to 500 KHz, 3 watts into 600 ohms, tests loops over 200 miles long ..... **$75.00**

**HP (BOONTON) 240A SWEEP SIGNAL GENERATOR:** Designed for alignment of broadband amplifiers, 4.5 to 120 MHz range. Output 1μV to 0.3V. ..... **$395.00**

**HP 616A SIGNAL GENERATOR:** 1.8 GHz to 4.2 GHz. ..... **$395.00**

**HP 684C SWEEP GENERATOR:** 4 to 8.1 GHz range, sweep rates 16 MHz to 160 MHz/sec in 9 steps. 10mw output. Bad BWO ..... **$395.00**

**HP 686A SWEEP OSCILLATOR:** Electronic sweep with sweep rate from 32MHz to 320Hz/sec in 9 steps. 8.2 to 12.4 GHz range ..... **$395.00**

**HP 686C SWEEP GENERATOR:** Same as 684C except 8.2 MHz to 12.4 GHz unit ..... **$395.00**

**HP 938A MICROWAVE DOUBLER:** 9 to 13 in, 18 to 26 GHz output at 10mW ..... **$995.00**

**HP (DYMEC) DY5731 HIGH POWER SIGNAL GENERATOR:** X-Band, +24 to −76dBm ... **$495.00**

**HOLT AO-1 AUDIO OSCILLATOR:** 20 to 20 KHz, less than 0.1% distortion ..... **$125.00**

**JERROLD CM-6 PORTABLE CRYSTAL MARKER GENERATOR:** Six crystal markers between two and 100 MHz, up to 20th harmonic ..... **$150.00**

**CAUTION:** THESE INSTRUMENTS ARE SOLD AS-IS. WHILE EVERY ATTEMPT IS MADE TO ASSURE COMPLETENESS AND TO DELIVER AN OPERATIONAL INSTRUMENT, THERE IS NO WARRANTY IMPLIED OR STATED EXCEPT: "YOU MAY EXAMINE THE UNIT FOR TEN DAYS AND, IF YOU ARE NOT SATISFIED, YOU MAY RETURN FOR FULL CREDIT PAYING ONLY THE FREIGHT CHARGES". EVERY TECO INSTRUMENT IS CONSIDERED TO BE A GENUINE BARGAIN, BUT THE BUYER SHOULD HAVE ACCESS TO COMPETENT TECHNICAL TALENTS TO MAKE THE PURCHASE PRACTICAL.

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## SIGNAL GENERATORS Continued

**JERROLD 601 SWEEP FREQUENCY GENERATOR:** 12-225 MHz, 50Ω output, small portable ..... **$150.00**

**JERROLD 900A SWEEP GENERATOR:** 500 KHz to 1200 MHz, many features ..... **$395.00**

**KAY MEGA-NODE SR VARIABLE NOISE GENERATOR:** 1-3000 MHz, 50Ω output, 0-20dB noise figure measurement, ±0.25dB accuracy **$75.00**

**MAXON 1141A POWER OSCILLATOR:** 200 to 2500 MHz, 5 to 40 Watts output ..... **$495.00**

**MEASUREMENTS 80 SIGNAL GENERATOR:** Covers UHF from 2 to 400 MHz and 0 to 10,000μV calibrated output ..... **$295.00**

**MEASUREMENTS 82 SIGNAL GENERATOR:** 20 Hz to 50 MHz, 0 to 50V output, 0-50% internal modulation. ..... **$325.00**

**MEASUREMENTS 84 TV SIGNAL GENERAL:** 30 MHz to 1000 MHz, 75 ohm, 0.1μV to 1V output **$275.00**

**MEASUREMENTS 88 FM SIGNAL GENERATOR:** 88 to 108 MHz, 0.1 to 100,000μV output ..... **$150.00**

**MEASUREMENTS 188 FM SIGNAL GENERATOR:** 88 to 108 MHz, 0.1 to 100,000μV Output ... **$350.00**

**MEASUREMENTS 210A SIGNAL GENERATOR:** 86 to 108 MHz. FM generator with 0.5% dial accuracy, 50Ω 0.1 to 100,000μV output ..... **$125.00**

**MILITARY TS-382 AUDIO GENERATOR:** 20 Hz to 200 KHz ..... **$65.00**

**POLARAD HU-2A BASIC SIGNAL GENERATOR:** Requires "G" series plug-in to operate ..... **$350.00**

**POLARAD G SERIES TUNING UNIT FOR HU-2A:** 7 units cover band from 18.0 go 39.7 GHz, 10mW average power output, 0.1% frequency accuracy, attenuator and wavemeter ..... **$300.00 each**

**POLARAD KX-B MICROWAVE SIGNAL SOURCE:** 1.05 to 10.75 GHz, 5 foot rack includes cabinet **$995.00**

**PRD 903 SIGNAL GENERATOR:** 7-11 GHz, CW, FM, pulse ..... **$195.00**

**PRD 904 VHF-UHF NOISE GENERATOR:** 30-1000 MHz ..... **$250.00**

**RUTHERFORD B-2A PULSE GENERATOR:** 10Hz to 100 KHz, variable parameters ..... **$45.00**

**RUTHERFORD B-7 PULSE GENERATOR:** 20Hz to 2MHz, all variable parameters ..... **$125.00**

**RUTHERFORD B-7B PULSE GENERATOR:** 20Hz to 2MHz, late model of B-7 ..... **$225.00**

**RUTHERFORD B-14 PULSE GENERATOR:** 20Hz to 2MHz, solid state units ..... **$125.00**

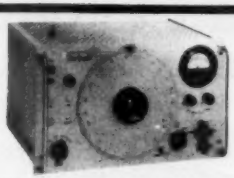
**SIERRA 215B-470 POWER OSCILLATOR:** 150 to 450 MHz, 50 watts output ..... **$795.00**

**TMC TTG-2 TWO-TONE TEST GENERATOR:** 25 Hz to 1 MHz ..... **$75.00**

**TEKTRONIX 105 SQUARE WAVE GENERATOR:** 25 Hz to 1 MHz ..... **$75.00**

**TEKTRONIX 180A TIME MARK GENERATOR:** Excellent units ..... **$195.00**

**WAVEFORMS 401B AUDIO OSCILLATOR:** 10Hz to 100KHz ±3%, 4 decade bands with 20V unloaded output (160mw), 600Ω impedance ..... **$125.00**



**HP 233A (MILITARY SG-71B) CARRIER TEST OSCILLATOR:** A bargain hunter's delight. The 233A checks carrier current systems and much more. This fine oscillator generates 3 watts output into 600 ohms over the frequency band from 50 Hz to 500 KHz making possible a variety of tests including 100 to 200 mile loop tests. A second 6V at 600Ω output can be used simultaneously for other tests. New price exceeds $700.00.
TECO price for this special ..... **$75.00**

**MILITARY UPM-4A TRANSPONDER TEST SET:** Three piece unit in single cabinet includes power supply, simulator unit and oscilloscope display unit. The UPM-4A performs many measurements on radar equipment operating in the 925 to 1225MHz range including checks on decoding, receiver bandwidth and frequency, receiver sensitivity, pulse counting, pulse analysis and IFF target generators. This unit sold new for nearly $5000 but at TECO its cost is a low **$175.00**

**MILITARY AN/UPM-15 200 VOLT PULSE GENERATOR.**
A portable, general purpose pulse generator set used for testing pulse amplifiers and networks, and for modulating oscillators in field and depot maintenance. It generates single or double pulses of variable repetition rate, width, amplitude, separation, delay and rise decay time. The pulses may also be synchronized with oscillators or other instruments. Output rep rate is externally or internally variable from 50 Hz to 10 KHz, pulsewidth variable from 0.5 to 100μ seconds, amplitude 0.002 to 200 volts and calibrated delay from 2 to 225μsec. An extraordinary value ..... **$50.00**

**TEKTRONIX 1121 AMPLIFIER:** 5Hz to 17MHz, gain of 100 ..... **$175.00**

**WEINSCHEL CF-1 AF SUBSTITUTION ATTENUATOR:** For use with square low detector .. **$150.00**

**WEINSCHEL IN-1 AUDIO LEVEL INDICATOR:** For use with square low detector ..... **$50.00**

**MILITARY TEST EQUIPMENT** is the biggest value for your money. Each military unit is ruggedized and constructed of the highest quality parts. The U.S. government has put severe MIL-SPECS into each of their purchases assuring YOU an instrument now that bears the U.S.A. mark of quality and yet is usually less expensive. Examine the Military units carefully for BEST BUYS - call TECO for your requirements that cannot be filled by this brochure. TECO has thousands of instruments that, due to space limitations, are not shown in this brochure.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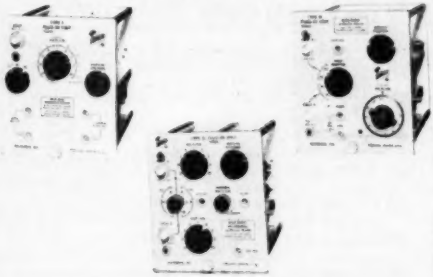
# OSCILLOSCOPES AND RELATED INSTRUMENTS

**DUMONT 304 OSCILLOSCOPE:** DC to 300 KHz **$75.00**
**DUMONT 401 OSCILLOSCOPE:** DC to 500 KHz **$125.00**
**HP 185 SAMPLING OSCILLOSCOPE:** DC to 1 GHz ..... **$195.00**
**HP 1100A DELAY LINE:** 120nsec ..... **$75.00**



**TEKTRONIX OSCILLOSCOPE PLUG-INS:** Can be used with the 530, 540 or 550 series oscilloscopes with equal performance.
Model 53/54C dual trace 20 MHz unit ..... **$95.00**
**TEKTRONIX A PLUG-IN:** DC - 20 MHz wideband DC. ..... **$40.00**
**TEKTRONIX B PLUG-IN:** DC 20 MHz High gain wide band ..... **$50.00**
**TEKTRONIX C PLUG-IN:** DC - 24 MHz Dual trace. Same as Model CA except no algebraic add. **$125.00**
**TEKTRONIX CA PLUG-IN:** DC - 24 MHz dual trace ..... **$150.00**
**TEKTRONIX E PLUG-IN:** DC - 60 KHz differential. ..... **$75.00**
**TEKTRONIX G DIFFERENTIAL PLUG-IN:** 50mV to 20V/cm sensitivity, DC to 20 MHz bw, 18ns risetime. ..... **$65.00**
**TEKTRONIX H SINGLE TRACE PLUG-IN:** 50mV to 20V/cm sensitivity, DC to 15 MHz bw, 23ns risetime. ..... **$75.00**
**TEKTRONIX K SINGLE TRACE PLUG-IN:** 50mV to 20V/cm sensitivity, DC to 30 MHz bw, 12ns risetime ..... **$50.00**
**TEKTRONIX R PLUG-IN:** Transistor risetime .. **$65.00**
**TEKTRONIX 82 DUAL TRACE PLUG-IN:** For use with 585 scope, 10 mV to 5V/cm sensitivity, DC to 80 MHz bw, 4ns risetime ..... **$395.00**
**TEKTRONIX 262 PROGRAMMER:** Remotely program the 6R1A digital unit ..... **$250.00**
**TEKTRONIX 517 OSCILLOSCOPE:** DC to 1 GHz with power supply ..... **$295.00**
**TEKTRONIX 535 OSCILLOSCOPE:** DC to 11 MHz less plug-in ..... **$425.00**
**TEKTRONIX 536 OSCILLOSCOPE:** DC to 15 MHz less plug-in ..... **$350.00**

# RECORDERS AND PRINTERS

**BRUSH RE3610-60 100 CHANNEL EVENT RECORDER:** "as-is" ..... **$150.00**
**CEC 5-119 OSCILLOGRAPH:** Light-beam recorder accepts up to 36 or 50 galvanometers, 12" paper, 16 paper speeds with magazine ..... **$495.00**
**EAI BAR CHART RECORDER:** 40 channels recording time 9, 18, 27 hours ..... **$150.00**
**ESTERLINE ANGUS RECORDER:** Different models available ..... **$75.00**
**FAIRCHILD 321-A OSCILLOSCOPE RECORD CAMERA:** Continuous motion 35mm camera with magazine and variable speeds ..... **$75.00**
**HP 560A DIGITAL PRINTER:** Up to 11 columns capacity with plug-in boards, 5 line/second print speed ..... **$250.00**
**HP 561B DIGITAL PRINTER:** Up to 8 columns, 5 line/second speed ..... **$225.00**
**L&N W RECORDER:** 24 point portable recorder **$525.00**
**RUSTRAK 120B DUAL CHANNEL RECORDER:** 100 to 140 VAC, 0 to 5 amps ..... **$80.00**
**RUSTRAK 133 TEMPERATURE RECORDER:** 15C to 55°C. ..... **$65.00**
**SANBORN 150 SERIES:** All types amplifiers, recorders, plug-ins. Write for details. ..... **P.U.R.**
**TI RECTIWRITER:** Dual channel, 1mA movement, multispeed ..... **$75.00**

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## MISCELLANEOUS

**ALFORD 1128-PS AUTOMATIC IMPEDANCE PLOTTER:** ..... $175.00
**ALFORD 3775 TRANSFEROMETER:** 1.0 to 3.2 GHz band, for use with AMCI plotters ..... $395.00
**ARRA COAXIAL VARIABLE ATTENUATORS:** Many models to choose from, N connectors ..... $50.00
**BENDIX 634N RF LOAD:** 150 Watts ..... $50.00
**BENDIX 636NC TERMINATION:** 600 watts continuous, 50Ω, 0 to 36Hz range, N(F) connector . $95.00
**BIRD 883 TERMINATION:** 1000 watts continuous, 50Ω, LC connector ..... $95.00
**BIRD 888 TERMINATION:** 1200 watts continuous, 50Ω, N(F) connector ..... $105.00
**BIRD 8221 TERMINATION:** 500 watts continuous, 50Ω, LC connector DC to 2GHz bandwidth . $75.00
**BIRD 8841 COAX TERMINATION:** 1000 watts continuous, 50Ω, LC connector ..... $95.00
**BIRD 8890 TERMINATION:** 2500 watts continuous, 50Ω, OC connector, includes BA-88 blower . $195.00
**DYMEC 2307A SERVO PROGRAMMER:** ..... $295.00
**DYMEC 2420A MEASUREMENT CONTROL UNIT:** ..... 295.00
**DYMEC 2530A BINARY/DECIMAL REGISTER:** Includes 2532A digital comparator ..... $295.00
**DYMEC 2550A DUAL REGISTER:** ..... $200.00
**DYMEC 2551A DUAL REGISTER:** ..... $200.00
**DYMEC 5207-1 V-F CONVERTER:** ..... $200.00
**GR 723C VACUUM TUBE FORK:** 100 Hz ..... $25.00
**GR 1206B UNIT AMPLIFIER:** 20Hz-50KHz, 3 watts output, requires unit power supply ..... $45.00
**GR 1213C UNIT TIME/FREQUENCY CALIBRATOR:** 1ppm/day stability ..... $45.00
**GR 1219A PULSE AMPLIFIER:** ..... $70.00
**GR 1231B AMPLIFIER AND NULL DETECTOR:** 50 Hz - 100 KHz ..... $50.00
**HP 297A DIAL SWEEP DRIVE:** For use with 302, 310 and 312 analyzers. Connects to dial and sweeps from 64 revolutions to 10 with shaft speed of 1 RPM or 10 RPM ..... $195.00
**HP 344A-78E MODULATOR:** ..... $10.00
**HP 344A-78G MODULATOR:** ..... $10.00
**HP 750 SERIES CROSSGUIDE COUPLERS:** Most W/G sizes and values, specify ..... $20.00
**HUGHES IGC-101 IONIZATION GAUGE CONTROL:** ..... $95.00
**HUGHES VTW-30C STORED ENERGY WELDING POWER SUPPLY:** ..... $95.00
**JERROLD TC-3 ELECTRONIC SWITCH:** ..... $45.00
**KROHN-HITE 310AB ELECTRONIC FILTER:** 20Hz to 200KHz bp filter with adjustable bw and cf. $90.00
**L&N 9835B DC INDICATING AMPLIFIER:** Can be used as null detector, direct reading indicator or recording preamplifier ±25μV to ±1V ..... $95.00
**RAYTHEON 60C WELDER:** ..... $100.00
**SIERRA 185A-1000 TERMINATION WATTMETER:** 2 110 MHz, 0 to 300, 1000 Watts ..... $225.00
**HP 340B NOISE FIGURE METER:** Automatically measures and displays IF or RF amplifier noise figure at 30 ro 60 MHz. Bandwidth 1 MHz with input from −60 to −10dBm. Powers HP 340 series noise generators ..... $395.00
**AMI 500 FM MONITOR DEVIATION CALIBRATOR:** ..... $395.00

## MISCELLANEOUS

**BIDDLE 601235 STANDARD RESISTOR:** NBS Type 0.01 ohm, new ..... $50.00
**GR 107 SERIES VARIABLE INDUCTOR:** Specify inductance range ..... $30.00
**GR 219 SERIES CAPACITANCE BOX:** 3 decades with low loss mica capacitors ..... $20.00
**GR 544B MEGOHM BRIDGE:** 0.1 - 1,000,000 megohm range ..... $150.00
**GR 602 SERIES RESISTOR BOX:** ..... $20.00
**GR 716C CAPACITANCE BRIDGE:** 100pf to 1.1mf, 0.1% accuracy ..... $195.00
**GR 716P4 GUARD CIRCUIT:** Used with 716C $75.00
**GR 722D PRECISION VARIABLE CAPACITOR:** 255 to 1100pf ..... $65.00
**GR 722ME PRECISION VARIABLE CAPACITOR:** 10.5 to 105pF ..... $50.00
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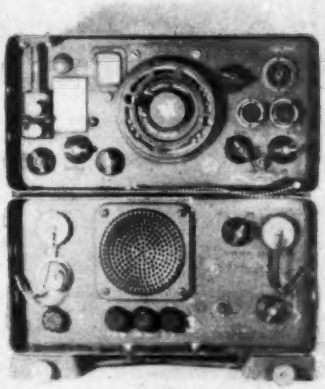
# The AN/GRR-5 Receiver



*Unconverted AN/GRR-5 Receiver.*

An interesting arrival on the surplus market is the AN/GRR-5 communications receiver. Its low price (around $50) and its wide coverage make it particularly attractive. The receiver tunes from 1.5 to 18 MHz in four bands. Other features include a built in 200 kHz crystal calibrator and provision for presetting ten channels with an ingenious mechanical channel selector.

As issued, it will operate from 115 Vac, 6, 12 or 24 Vdc or from a dry battery pack. The i-f is 455 kHz. The complete set consists of receiver R-174 and power supply PP-308 mounted in cabinet assembly CY-615. It has served nicely at this station for RTTY reception, and as a tuneable i-f for VHF experimentation. The preset detents are great for both applications as they facilitate quick monitoring.

Most of the receivers I have checked out were in good condition. Circuit diagrams are mounted under the bottom plates of the two units. To operate from the ac line simply connect the line cord to pins A and D of the power input plug J-103. Changeover from dc to ac is automatic. To operate from 6, 12 or 24 Vdc it is necessary to switch to the desired voltage and connect the positive lead to pin B of J-103 and the negative line to pin C of J-103.

Unfortunately, the set has a couple of failure modes. These receivers were designed in the early 1950's before the availability of silicon rectifiers. A selenium rectifier is used for filament rectification (CR 102 mounted on the case). A copper oxider bridge rectifier powers the ac transfer relay, and a high vacuum rectifier is used for the B+.

If the receiver doesn't work when plugged into the ac line and the fuse is ok, check to see if relay K-101 has pulled in. If it hasn't, the trouble is most likely the copper oxide rectifier CR 101. This is prone to failure from corrosion and can readily be replaced with a standard 1 Amp, 50 piv silicon bridge rectifier assembly. Incidentally, carefully inspect the receiver before you purchase it. The set is beautifully fungus proofed, but the relays aren't. I have frequently found the armatures corroded to the point where they won't actuate. This brings us to the second failure mode.

Transfer relay K-1-1 is the most common victim of corrosion. This is an 11 pole double throw relay. In the event it is bad the only solution is to completely rewire the power supply. Fig. 1 is the schematic of a new supply built from existing components. This power supply can also be used in the event you obtain a R-174 receiver without the PP-308 power supply. The output of the supply is adequate enough to power additional accessories such as 2nd i-f/ discriminator modules from R-257 or R-394 receivers* to provide FM reception. Removal of unused components from the PP 308

**These modules are available from Fair Radio Sales, Lima Ohio.*

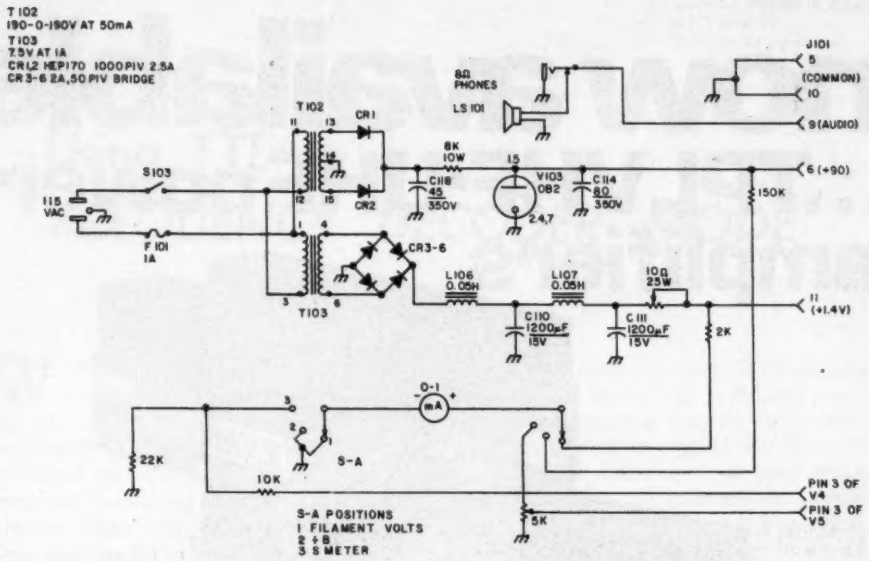


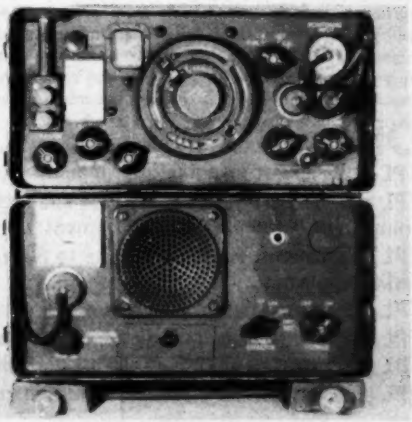

*Fig. 1*

results in plenty of room to mount these modules.

The meter shown in the schematic permits monitoring and adjustment of the filament voltage, monitoring of the B+ and it also functions as an S meter. In adjusting the filament voltage, start with the 10 ohm 25 W resistor set for maximum resistance. The audio output selector should be set at the high position. Adjust the slider for 1.4 Vdc under full load. This will result in about 1.5 V when the output selector is in the low position.

The closed circuit jack was installed in place of the speaker on/off switch. This permits use of 8 ohm headphones, or an extention speaker. The blast proof military speaker is great for listening to CW or communications traffic, but for short wave listening it leaves something to be desired. If you have 600 ohm headphones you can replace one of the jacks on the receiver (J-1 or J-2) with a conventional phone jack. Other small modifications can improve the operability. The twist type antenna connector should be replaced with a BNC connector if you are going to use the receiver as a tuneable converter. If you mount the converters in the rebuilt power supply, receiver relay K-1 can be used to transfer the antenna to the converter. A short piece of RG-58 cable is connected to K-1 with the center conductor going to pin B (clip the original wire going to that pin), and the shield terminated at the relay ground lug. A switch to activate the relay is then mounted on the panel of the power supply.

...W6JTT



*AN/GRR-5 converted with S meter and conventional phone jack.*

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# *Using TTL in a FREQUENCY DECODER MODE*

While taking stock of cash outlays already made on our (Echo Amateur Radio Group) moonbounce, Tropo, Oscar installation being built at my QTH, it was noted that a large portion of the total investment was being used for the repeater function described by me earlier (73 Magazine, November 72, p. 271). It is our final goal to be able to license a repeater that complies with the new FCC rules and regulations (alone a feat!) and repeats out anything it hears on the EME, Tropo, or Oscar link onto a 2m FM transmitter on some unused simplex frequency. The user can then return or originate a call from his own home via his 2m FM transmitter to my QTH and have it repeated out on the EME, Tropo, Oscar path. Money being what it is (scarce!), this should explain the first reason why this construction project was dreamed up.

### Computer Thinking

Some better type of *Touchtone decoding was required if we were going to stay within our limited budget and prove EME, etc., need not cost an arm and a leg if done on a group basis and then shared by using a repeater to access the site. Since decoding by any of LC, twin-T, active filters, or Phase Locked Loops (PLL), require test equipment and tuning, none of them are easy or particularly inexpensive. It was the cost of eight PLL ICs that drove me to keep thinking and come up with the way used in this article.

Since decoding is generally done by some type of filtering, and I had almost resigned myself to it, the test equipment was checked over to make sure all was O.K. since lightning hit here last month. It should have come to mind sooner, but it did not until I got to the frequency counter. I thought I was going to need to align things. Then the lights began to flash up in the grey matter between my ears. If a frequency counter were used as the decoder, the same unique decoding of the incoming tones could not only be done, but displayed in easy fashion.

I have already built the frequency counter described by K2OAW, presented last year in 73 Magazine, and between that and my job, I realize the availability of inexpensive TTL ICs necessary to build a counter. For the K2OAW model it requires 32 TTL ICs, and would hardly seem to be cheaper – it's not. But then you don't need 20 MHz capability for openers. Secondly, you need display only one number for HI tones and one for LO tones, if you desire the display at all! The frequency counter (counters) you

| IND | IS |
|---|---|
| 62 | 1 |
| 63 | 2 |
| 64 | 3 |
| 66 | A |
| 72 | 4 |
| 73 | 5 |
| 74 | 6 |
| 76 | B |
| 82 | 7 |
| 83 | 8 |
| 84 | 9 |
| 86 | C |
| 92 | * |
| 93 | Ø |
| 94 | # |
| 96 | D |

*Chart 1. Display*

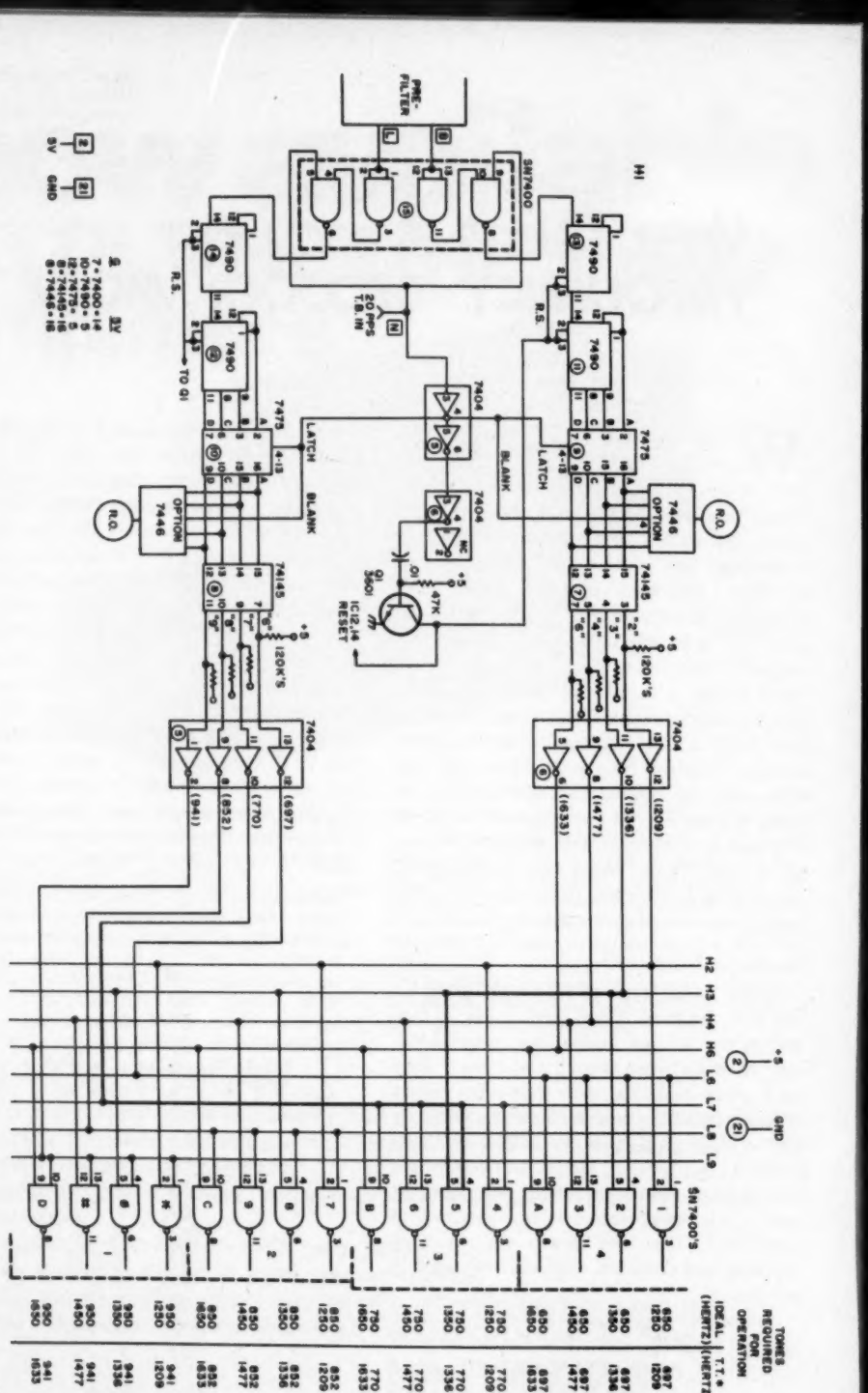
PRE-FILTER
SN7400
7490
7475
7446 OPTION
74145
7404
20 PPS T.B. IN
R.S.
LATCH
BLANK
R.O.
TO Q1
Q1 2N3904
IC12-14 RESET
47K
120K'S
+5
GND
SN7400'S
H1
H2
H3
H4
H6
L6
L7
L8
L9
TONES REQUIRED FOR OPERATION
IDEAL (HERTZ)
T.T.* (HERTZ)
697 1209
697 1336
697 1477
770 1209
770 1336
770 1477
852 1209
852 1336
852 1477
941 1209
941 1336
941 1477

*Fig. 1.*

# Put together the top-value Heathkit 2-meter package!

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**Kit HW-202,** 11 lbs., mailable . . . **179.95***

**Kit HWA-202-2,** Tone Burst Encoder, 1 lb. . . **24.95***

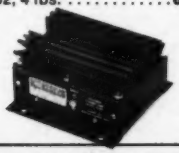
**Kit HWA-202-1,** AC Power Supply, 7 lbs. . . . . **29.95***

**Kit HWA-202-3,** Mobile 2-Meter Antenna, 2 lbs. . . . . **17.95***

**Kit HWA-202-4,** Fixed Station 2-Meter Antenna, 4 lbs. . . **15.95***

### Add 40 watts of output

with the Heathkit HA-202 2-Meter Amplifier. It's designed for the HW-202, 4 lbs. . . . . **69.95***



### Tune-up your 2-meter rig

with maximum precision. The Heathkit HM-2102 VHF/SWR Bridge makes it happen, 4 lbs., . . . . . **34.95***

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HA-201, is perfect for hand helds or any 1 to 1½ watt 2-meter rig, 3 lbs. . . . . **25.95***

**HW-202 SPECIFICATIONS — RECEIVER — Sensitivity:** 12 dB SINAD* (or 15 dB of quieting) at .5 μV or less. **Squelch threshold:** 3 μV or less. **Audio output:** 2 W at less than 10% total harmonic distortion (THD). **Operating frequency stability:** Better than ±.0015%. **Image rejection:** Greater than 55 dB. **Spurious rejection:** Greater than 60 dB. **IF rejection:** Greater than 75 dB. **First IF frequency:** 10.7 MHz ±2 kHz. **Second IF frequency:** 455 kHz (adjustable). **Receiver bandwidth:** 22 kHz nominal. **De-emphasis:** −6 dB per octave from 300 to 3000 Hz nominal. **Modulation acceptance:** 7.5 kHz minimum. **TRANSMITTER — Power output:** 10 watts minimum. **Spurious output:** Below −45 dB from carrier. **Stability:** Better than ±.0015%. **Oscillator frequency:** 6 MHz, approximately. **Multiplier factor:** X 24. **Modulation:** Phase, adjustable 0-7.5 kHz, with instantaneous limiting. **Duty cycle:** 100% with ∞ VSWR. **High VSWR shutdown:** None. **GENERAL — Speaker impedance:** 4 ohms. **Operating frequency range:** 143.9 to 148.3 MHz. **Current consumption:** Receiver (squelched): Less than 200 mA. Transmitter: Less than 2.2 amperes. **Operating temperature range:** −10° to 122°F (−30° to +50° C). **Operating voltage range:** 12.6 to 16.0 VDC (13.8 VDC nominal). **Dimensions:** 2¾" H x 8¼" W x 9⅞" D.

*SINAD = $\frac{\text{Signal + noise + distortion}}{\text{Noise + distortion}}$

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really need for this job never has to "count" over 2000Hz by the nature of the input, and really never over 200Hz due to the counting scheme I used. As can be seen in the logic diagram in Fig. 1, there is very close similarity between the HI and LO tone groups, and for this reason I will refer to them as the hi channel (processes 1209Hz, 1336Hz, 1477Hz, and 1633Hz) and the LO channel (processes 697Hz, 770Hz, 852Hz and 941Hz).

Circuit description and functions:

I will cover the various functions in the following manner:

- HI channel
- LO channel
- Clocking and control
- HI and LO to digit decoder
- Pre-filters (to split groups)
- Power supplies
- HI channel

The input to the HI channel is taken from the HI pre-filter output and applied to both inputs of one NAND gate of an SN7400 (IC15, pins 12 and 13). This shapes the input sine wave to the square wave required by the TTL logic. From the output of this IC (pin 11) the square wave is passed on to one input of a second NAND gate (IC15, pin 10). Each time the input here goes HI it half enables the gate. The HI required for the other input of this gate (pin 9) is supplied by the clocking and control section and will be covered in that section.

Assume for the moment the HI is present from clocking and control. This HI allows the tone applied to the gate (pin 10) to be passed out of the output of this gate (pin 8) and on to the first HI channel counter (IC13). It is inverted from the input to this gate, and in phase with the original input, but it does not really matter for our use.

The HI tone enters the first counter (IC13, SN7490) on pin 14. The IC is wired as a ÷ by 10. If you look at the output at pin 11 with a scope or counter you will, however, see 1/100 of the input tone frequency. This is due to the gating used from the clocking and control. From the output of this counter (IC13, pin 11) the signal is routed to a second counter, also wired as a divide by 10. The second counter (IC11) input is on pin 14. Pins 1 and 12 of both

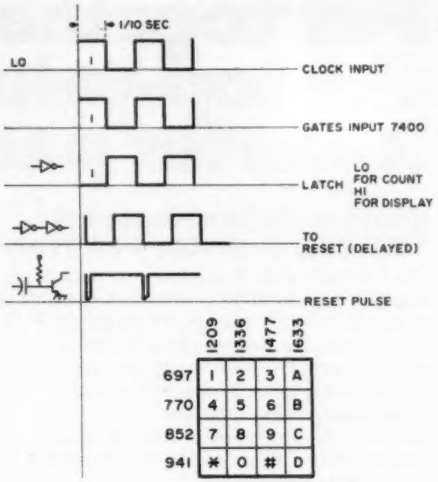


*Chart 2. Timing*

counters in both channels are tied together, pins 6, 7 and 10 are grounded, all pins of 2 and 3 are tied together and to the collector of Q1 for reset, all pin 5s tie together and to +5V and pin 14 is the input for all counters. This wiring is for the four HI and LO channels only, and is correct for the ÷ by ten function they perform.

The point of all this can best be shown by an example. If 1209Hz were placed on the input to the SN7400 gate and it was gated properly, the proper BCD code would appear on the output line of the second counter IC11. For 1209Hz, the 2 is the digit we are interested in. By proper gating, this two is on the BCD output lines at the end of the "gated on" or count period. The gate is then shut off and the output used to control IC9. Since the BCD is changing as the counter counts, we cannot use the BCD directly to a decoder. Only when the BCD code is right for the number representing the input can we use it. Something is needed to allow the BCD code to travel on only when we want it to.

This something is IC9 (SN7475). By wiring this IC in the correct manner, it only "transfers" the BCD input to the output when its clock, or latch, lines are HI. This is pin 4 and 13 of each IC (one per channel). The clock control supplies this HI only at

the proper time. When the HI is applied, the BCD is transferred to the outputs. From these outputs, the code is sent two ways if you choose to run a display. I suggest you do, as it is a great check of everything to this point as you build the decoder, and a terrific troubleshooting aid in the future.

The BCD code is applied to a BCD 7-segment decoder that will depend on the type of display you use. In my case, I used SN7446s, as I used *Numitrons for my readouts. The blanking line (pin 4) is tied into the clock control, so that only the transferred number is displayed. A ' flicker ' in the readout is normal and it tells you the clock control is running. The board layout will vary somewhat depending on your choice of readouts, but all the decoder circuits remain the same.

The second place the BCD code is applied is to a BCD to decimal decoder (IC7, SN74145 or 7445). This IC takes the BCD code present on four lines and converts it to a single output LO at line 2 (pin 3) in the case of our 1209Hz example. The four used outputs in each of the HI and LO channels are committed to +5V thru 120K resistors. These resistors hold the uncommitted collectors of the IC at a HI until that particular number is received and decoded. In the HI channel, only when the numbers 2, 3, 4 or 6 representing 1209Hz, 1336Hz, 1477Hz and 1633Hz, is received, encoded to BCD by counting, transferred by the latch and decoded by the decoder, will there be a LO at the proper decoder output. It will remain there as long as the tone is being received.

Due to the decoding used by section D to get two decoded tones to represent only one number, a TTL HI is needed from the decoder output. I have added an invertor to the outputs in the form of IC6 (SN7404), to get them right side up. There are six invertors per IC, but only four are used on the outputs you want to monitor. The extra pair are used in the clocking and control section. The outputs from pins 12, 10, 8 and 6 are now ready to go to section D for final decoding.

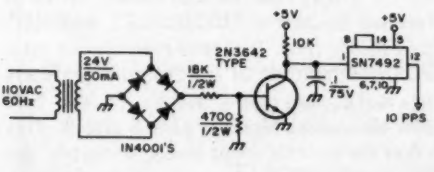


*Fig. 2*

**LO Channel**

I mentioned the similarity of HI and LO channels earlier so that at this point I can say they work identically. Note the difference being the counting of information from the LO tone prefilter, and the use of different output lines of the decoder. IC8 in order to decode a 6, 7, 8 or 9 representing 697Hz, 770Hz, 852Hz or 941Hz. It should also be said here, that if you are making your own pads to be used on the sending end, center them on the 50Hz points (i.e. 650Hz, 750Hz, 1350Hz, etc.) and it allows you a ±50Hz error in tones before a malfunction occurs in the decoder. This may interest some of you, and I hope to have our control pad finished soon for a follow up article to this. The fact you can have a 50Hz error in input tones really is not leaving yourself "wide open," as you still must have two tones to actuate anything. Any of you using our type of pad, where the tones are all 50s can reduce this to a ±10 cycle tolerance very cheaply, and I will include this with the pad article. Other than the changes mentioned, the LO channel is identical to the HI channel.

**Clocking and Control**

This is the "brains" of the system, just as in any counter, so be careful to get things right here. In order to speed the operation of decoding by more "samples" per second, and to lessen the parts required, a readily available time base was used. Namely the power line frequency. If you operate from other than 60Hz, you will have to modify the time base accordingly. What you desire as an output from the clock is a 10Hz *symetrically* shaped square wave. Note, to function properly, the output must be 10Hz and symetrical, and this is not how TTL necessarily works. For 60Hz, run a bridge rectifier from a transformer as I did, and divide it by 12 in an SN7492, IC16. This is a symetrical division if the IC is wired as I did mine, and you have your clock rate very easily.

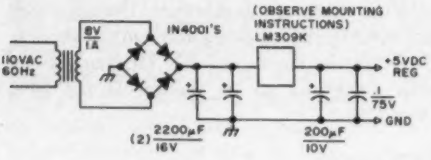


*Fig. 3*

In parts A and B, a HI was required to turn on the count enable gates (SN7400). The 10Hz clock rate from the clock control may be applied directly to these two points (IC15, pins 5 and 9), and it will allow the gates to count for the portion that the square wave is HI. This is a sneaky way to again divide the input frequency by ten, since the gate only allows the counter to look at 1/10 of the incoming frequency. This shifts the decoded or displayed digit one more place to the right, and reduces both channel counters required by one.

Now that the gates have been turned on to count, next you must do something with what you have counted. In the center of Fig. 1, the 10Hz is passed to one inverter of IC5 (SN7404) by attaching it to pin 3. As the clock goes LO after allowing a counting period with its HI, we would like to transfer that count to the display and decoder. That transfer requires a HI applied to IC9 and 10, pins 4 and 13 of both. We have a LO at the clock input point, but after the inverter it is now a HI. This is applied to the four pins stated causing a "transfer." Your numbers are now decoded and displayed.

Now all that remains for the clock control is to reset all the counters for the next count. Since, for this type of decoder, we want the output lines to remain LO as long as the tones are present, we cannot reset the counters anytime while "transfer" is taking place. In order to keep all of this very inexpensive and the clock control simple, there is only one other time we can reset the counters. That is during the period when we are supposed to be counting. If it were done immediately as the latch line were returning LO, the counters might "see" their reset or zero position, and transfer this. Since we may later choose to decode other than the four numbers of the HI and LO channels stated here, zero might be a valid command for us, and we didn't want any outputs that did not represent a valid frequency input. For this reason, the counters do indeed reset right at the beginning of the count. A "delay" introduced by passing the output of IC5, pin 4, through two more inverters, IC5 (in pin 5, out pin 6) and IC6 (in pin 3, out pin 4) keeps the false decoding of the zero mentioned above from happening. Note, you invert twice, therefore no inversion takes place, but you do slow down the signal being passed by what is called the TTLs propagation delay. In this case, about 8 to 15ns per inverter. This LO is then ac coupled from IC6 to pulse the transistor (Q1) off very briefly, disabling the count and resetting the counters. Q1 is held on to enable the counters by a small bias applied through a 47K resistor to +5V from the base. The combination of delay and the pulse width of the reset pulse is the amount of incoming frequency that will be "missed." For those of you who worry about built in errors, the total lost time is less than .2ms out of a 50ms count window. This is not enough to worry about or affect the significant digit you are trying to count.

### HI and LO Channel Output To Single Function

This has been described many places before and is quite commonly used even with PLL type tone decoders, so I will not go into detail here.[1] It uses SN7400 NAND gates. Wire the inputs in this manner: one to a HI channel output and one to a LO channel output. When these both go HI (after the inverters), the output goes LO giving a one of sixteen number possibility the same as that sent.

### Prefiltering

Here, too, any filter used for the PLL decoders will work,[2] or the LC type used for RTTY if they have enough bandwidth when retuned to 563 to 1075Hz (LO), and 1075 to 1767Hz (HI). Just remember to use only enough amplitude to and from the prefilters to make the input shapers in the first SN7400 work. Monitor pins 6 and 8. This takes 0V to +5V input levels, so rectify the filter outputs to keep minus off the SN7400, but do not put any capacitors here. The

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☐ **6 WPM** This is the practice tape for the Novice and Technician licenses. It is made up of one solid hour of code, sent at the official FCC standard (no other tape we've heard uses these standards, so many people flunk the code when they are suddenly — under pressure — faced with characters sent at 13 wpm and spaced for 5 wpm). This tape is not memorizable, unlike the zany 5 wpm tape, since the code groups are entirely random characters sent in groups of five. Practice this one during lunch, while in the car, anywhere and you'll be more than prepared for the easy FCC exam.

☐ **14 WPM** Code groups again, at a brisk 14 per so you will be at ease when you sit down in front of the steely eyed government inspector and he starts sending you plain language at only 13 per. You need this extra margin to overcome the panic which is universal in the test situations. When you've spent your money and time to take the test you'll thank heavens you had this back breaking tape.

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explanation why not is partly obvious and partly too long to explain here, just take my word and don't. Set the input amplitude to the filters until nice square waves are found at pins 3 and 11, and at 6 and 8 if the clock is running. At pins 6 and 8 they will appear as bursts of square waves. I would offer some of our prefilter here, but it has stiffer requirements and the PLL type works just fine.

### Power Supplies

Use any power supply required by the type of prefilter you use. The 741C op amp IC runs nicely from +10V, which can be gotten from the bridge output of the supply shown, for +5V regulated by using a resistor and zener combination. My +5V supply is shown in Fig. 3, and is "borrowed" directly from the repeater control article by K2OAW in March 1973, 73 Magazine. Any well regulated +5V supply capable of 900mA-1A works well in this application. Incidentally, repeater owners, that repeater control worked very well the first time I fired it up. I am now repeating my call automatically all over the basement like a kid with a new toy – hi!

### General

With everything wired and running the readouts should both flicker on "zero" with no input and display as in Table I, when tones are coming in. If you know the tones, just arrange your readouts with the LO to the left and HI to the right. Remember, the digit shown represents the "hundreds" of cycle column of the incoming frequency. With the clock line from clock control open the displays should blank. By using the displays you can check the gating and logic by applying only one frequency at a time from an audio generator to each input gate without the filters in place. In this case set the generator to the 50Hz points to allow for drift and read the readout in that channel for the significant digit (i.e. 6 for 650Hz). My sending pad is set up to send single or dual tone for just this reason.

Using the display, you can divide the system just as I did to describe it in order to localize difficulties. Get the time base going first, then the supply, then the channels one at a time, then the final decoders and last, the prefilters. This way you can check it out as you go. My offer of you sending an SASE for help still goes, as I have not been totally buried by mail from the last article.

### Conclusion

This decoder is not difficult to follow and is quite precise in operation with no tuning, so repeater control should be a natural for it. *Make sure* your pads are on frequency if they are commercial though. If you use them instead of my pads you are rather close to the edge of our passbands in places (i.e. 697Hz), so act accordingly! I am trying to come up with a board layout, but my own is wired and it took less than one afternoon. Best of building.

*Tradenames

1. Source unknown, but definitely borrowed.

2. L-C type and active type: Ham Radio, January 1973 P25 and P26 FM Repeater Decoder.

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DB METERING FOR BOTH CHANNELS

This deck has illuminated meters so you can set your levels right and keep an eye on them. Tape has a rather narrow range of recording level so good meters. . .ones that are easy to read. . .are very important. If your levels are too low the sound is down in the tape hiss. . .if they are too high you get distortion. You get the best dynamic range from your tape when you have good meters for setting your levels.

MANUAL VOLUME CONTROL

Not one of the lower priced cassette decks has a manual volume control for recording. This means that there is no possible way for you to do an adequate job of recording good music for the automatic gain controls they use raise and lower the gain for you and ruin the normal dynamic range of the music. They are handy for recording lectures where you can't keep an eye on the meters, but manual is best. Try recording Morse code on an AGC recorder!

PAUSE CONTROL

Another function found only on expensive recorders. . .the pause control allows you to stop the tape instantly so you can edit as you record. . .starts instantly too. You can't do without this for slow scan. The pause control permits you to turn on the deck and set your levels before starting the tape.

AUTOMATIC STOP

What do you think it does to a captain when it keeps going at the end of a tape. It doesn't do anything any good. It wears rapidly, thus changing the speed of your tape in the future. . .it quickly wears out the tape so it can break, etc. The more expensive decks stop at the end of the tape, automatically. You want this.

HEADPHONE OUTPUT

There are many times when you want to be able to monitor as you record, so you want some sort of headphone output. You may want to use the deck without any power amplifier. . .just plug in your headphones. Have you heard stereo with headphones? It beats speakers in every way. . .the results are incredible and suddenly you realize how fantastic stereo can really be.

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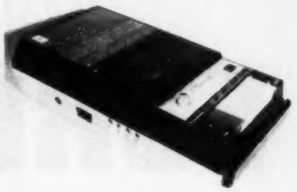

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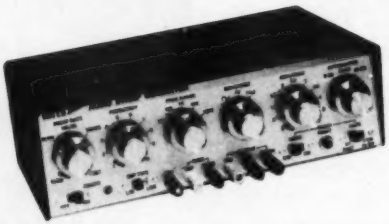

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# Simplifying Satellite DXing

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OSCAR-6 was up, and once again it caught me before I was ready. The Swan-270 and an 80/40 dipole couldn't hear it. Fortunately, a 75A-3 became available locally, and attached to a 10 meter dipole running due North-South five feet above the house roof, I was able to hear OSCAR-6. With the 75A-3 and dipole combination we encountered a lot of QSB and signals weren't very strong. What could be done, and for "peanuts?"

### What Type of Antenna?

Since the QSB appeared to be due to changes in polarization, an antenna had to be selected that would pick up both vertical and horizontal polarization. This eliminated the dipole and yagi – leaving quads, deltas and commercial crossed-polarization antennas. The experience of W5RK indicated that for DX work the delta was better than the quad, so the delta loop was chosen.

The original concept was to use a 4 element two-meter quad and a two element ten meter delta loop. Because we had an eleven element 2 meter beam we used that, and built a 10 meter 2 element delta loop (about 7 dB gain) for receive.

### The Steerable Mount

Lightning usually is bad luck, but this time it served us well. We picked up a lightning struck Ham-M ($30) and repaired it ($7.50) to use as the horizontal rotator. The azmuth rotor was a TV rotor with the mast fitting through the rotor and extending on both sides so we could mount an antenna on each end.

The Ham-M and assembly was mounted on a 10 foot two inch mast tied to a piece of wood 4 x 4 sunk 2½ feet into the ground. A 25 foot tower would be better, thus the Ham-M could be mounted inside and the tower provide an additional bearing surface for sideways torque. (See Fig. 5.) This mount has 360 degrees horizontal rotation and 180 degrees in azmuth (from horizontal to vertical and on over to horizontal again.)

### Delta Loop Antenna

The antenna is designed for 29.5 MHz

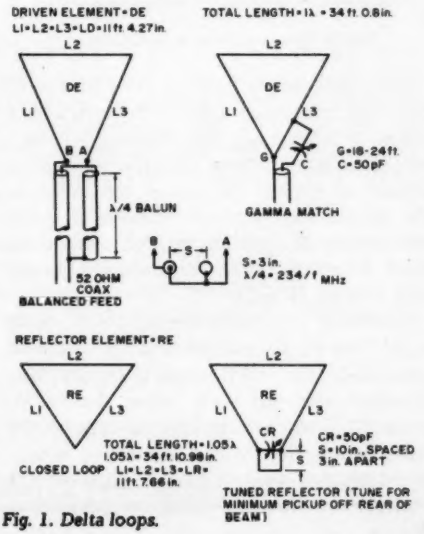

DRIVEN ELEMENT = DE
L1 = L2 = L3 = LD = 11 ft. 4.27 in.
TOTAL LENGTH = 1λ = 34 ft. 0.8 in.
L2
DE
L1
L3
B
A
λ/4 BALUN
52 OHM COAX
BALANCED FEED
G = 18-24 ft.
C = 50 pF
GAMMA MATCH
S = 3 in.
λ/4 = 234/f MHz
REFLECTOR ELEMENT = RE
RE
TOTAL LENGTH = 1.05λ
1.05λ = 34 ft. 10.98 in.
CLOSED LOOP L1 = L2 = L3 = LR = 11 ft. 7.66 in.
CR
CR = 50 pF
S = 10 in., SPACED 3 in. APART
TUNED REFLECTOR (TUNE FOR MINIMUM PICKUP OFF REAR OF BEAM)

*Fig. 1. Delta loops.*

with a driven element and a reflector separated about 0.125 wavelength. The driven element is one wavelength and the reflector is 1.05 wavelengths. Radiation impedance is about 70 OHM's, but I used a 52 OHM balanced feedline. For optimum performance the delta should be mounted at least 3/4 wavelength (25 feet) above ground. (Fig. 1.)

The six spreader arms are made of bamboo (or cane) poles, each 7½ feet long. The wire loop is strung through holes drilled at about 7 feet on each pole. Each set of three poles is mounted on an equilateral triangle of ½ inch (3/4 inch could be used) outdoor or marine plywood measuring one foot on each side.

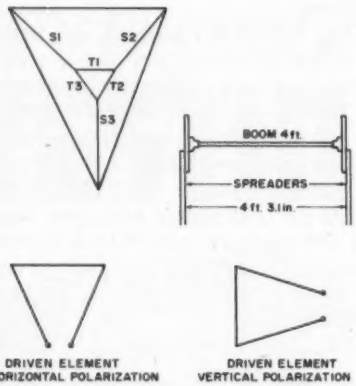
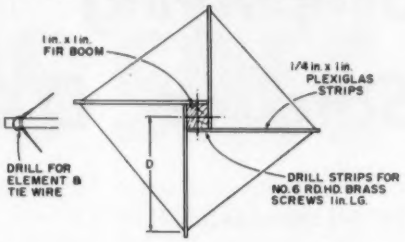



*Fig. 2. Delta mechanical construction.*

The delta boom is a four foot section of one inch galvanized water pipe with a pipe flange at each end. The plywood triangles are fastened to these flanges with bolts instead of screws. The overall separation of the driven and reflector elements is 0.125 wavelength (4 feet 3 inches). The delta boom is mounted to the transverse boom with U-bolts. (Fig.2.)

Reflector and driven elements were made of #18 plastic coated stranded hook-up wire (separated zip cord might be better). Stranded wire was used, rather than solid, because it is more resistant to damage by the wind flexing the delta. Coated wire is preferred because we have a very high corrosion problem this close (13 miles) to the Gulf of Mexico.

The reflector may be a continuous loop, or it can be tuned with a stub. We used a continuous loop without a tuning stub. The total length of the reflector is 1.05 wavelength (34 feet 11 inches at 29.5 MHz).




| ELEMENT | TOTAL LENGTH | ONE SIDE | D |
|---|---|---|---|
| DRIVEN | 6 ft. 10 3/4 in. | 20 3/4 in. | 14 2/3 in. |
| REFLECTOR | 7 ft. 2 7/8 in. | 21 3/4 in. | 15 2/3 in. |
| DIRECTORS | 6 ft. 6 5/8 in. | 19 2/3 in. | 13 7/8 in. |

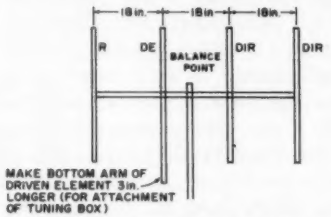



*Fig. 3. Two meter quad (W5ZG).*

The driven loop is one wavelength in total length (34 feet 1 inch at 29.5 MHz) and fed with a balanced 52 Ohms using a quarter-wave length balun. Seventy-two Ohm feed would be a better match, but I had only 52 Ohm coax on hand.

When the delta loop is fed at the down point, it is horizontally polarized. When the feed point is at one side or the other, the polarization is vertical. (Fig. 2.)

**Two Meter Antenna**

I used an 11 element beam, vertically polarized, but I would recommend a four element quad. I plan to replace the beam with a quad when I have time to build it.

Fig. 3 shows the design of a four element quad. The spreader arms are made of ¼" by 1" plexiglass strips. Two holes are drilled in the end of each plexiglass strip; one hole for the wire element and the outer hole for a tie wire. Make the bottom arm of the driven element 3" longer than the other three arms (for attachment of tuning box). Each element is separated 18 inches from other

elements. The boom is wood 1" x 1" and five feet long.

The two meter quad driven element is 6 feet 10¾ inches in total length, the reflector 7 feet 2 7/8 inches, and the directors are 6 feet 6 5/8 inches.

**Transverse Boom and Mounting**

The transverse boom is a 1½ inch water pipe (actually an old mast section) which is mounted through the elevation rotator. Two holes are drilled at each end for the U-bolts. When I have time the mount will be changed to that in Fig. 5 because of better balance.

Currently the elevation rotor is mounted on a Tee-connector and a short section of pipe forming the stem of the Tee is mounted in the Ham-M. The Ham-M is then mounted on the ten-foot pipe mast. A better mount is given in Fig. 5.

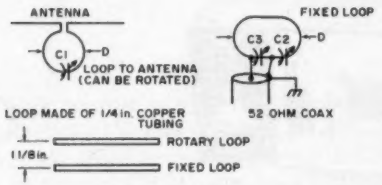



*Fig. 4. Beam matching, rotatable (W5ZG).*

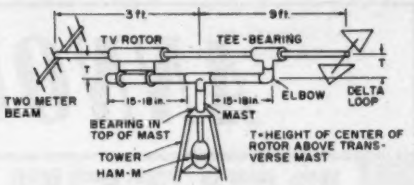



*Fig. 5. Torque mount.*

**Delta Data**

Design frequency = 29.5 MHz, gain = 7.4 dB (at 0.125λ).

Spacing between element: 0.125λ (4 feet 3.1 inches); 0.08λ = 52 Ohm rad. resistance; 0.13λ = 72 Ohm rad. resistance.

Height above ground = minimum of 3/4 (24 feet).

Antenna match = either gamma match, or balanced.

**Quad Data**

Design frequency = 2 meters; Spacing between elements = 18 inches; Antenna matching = rotating loop; See Fig. 4.

. . .WB5ASA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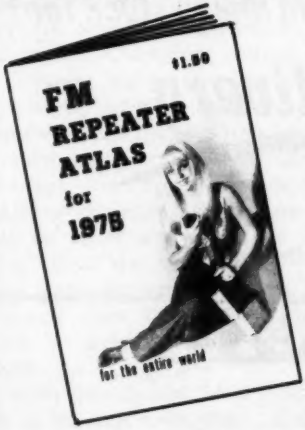


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# How I Blew a Bundle on TTLs

Over the past year or two, I have been building a variety of ham projects which use digital integrated circuits, usually the 7400-series TTL ICs advertised in almost every issue of 73 Magazine at bargain prices. But being basically stingy, about a year ago I tried to get these same ICs even cheaper, and wound up getting a lesson in economics – you pays for what you gets.

What caught my eye was an ad for "20 unmarked ICs for only $1.98 – three packages for $5." Wow – 60 ICs for $5 – that's less than a dime a piece! Now, I know that there are hundreds, perhaps thousands of different ICs by now, and identifying these unmarked ICs would be hard – almost impossible. But the nice part of this advertisement was that they were already partially presorted – you could buy a package of all digital, or all linear, or mixed, and there was even an assortment of "...all 7400-series TTL." That was the clincher – after all, there aren't that many different 7400-series ICs, and since they are similar anyway, right? My greed won out, and I ordered $5 worth.

When they arrived, identification turned out to be even easier than I thought, for I soon came up with some tricks (which we shall describe in a moment, in case you are still tempted after you finish reading this story). I went to work, and a few hours later had the 60 ICs divided up into three piles:

1. 20 good 7400-series ICs.
2. 22 partially working 7400-series ICs.
3. 18 other ICs, which were either completely dead, did strange things and could not be identified, or else were identified as being something other than a 7400-series TTL IC.

The 22 partially working 7400-series ICs were definitely identified as to what they were, but usually had some defect such as an open pin; most of these were gates with one input not working, or flip flops with one output not working. Thus these ICs could be used in some circuits as long as the non-working pin was not needed.

The 18 dead, unidentified, or non-7400-series ICs included some which were completely open on all pins (maybe they were empty packages?), some which did not seem to do anything in particular, some which we could identify as to what they did but could not find a type number for them in any of our catalogs, and two which were identified as Texas Instruments DTL digital ICs.

And so we wound up with 20 good ICs for $5, or about 25¢ a piece. That seems like a good buy, except that I found that some of the ICs, though perfectly good, didn't fit

into any of my immediate needs. For instance, there were six 7474 Type D flip flops, and five 7481 sixteen-bit memories. The remaining nine good ICs were all NAND gates of one kind or another. Put another way, we found that buying this type of variety pack was a chancy job at best and, in my case, definitely not worth the time, effort, and money. (But you may want to compare my results with an article entitled "Identifying Unmarked Surplus Digital ICs" in the September 1972 issue of CQ Magazine, page 44. I guess you have to be a born gambler.)

But, if you are still not discouraged, you may be interested in the tricks mentioned earlier. I was lucky to have two pieces of equipment which made the job much easier, though you could do without them. The first is an IC test socket, which is simply a 16-pin IC socket mounted on a board, with two pin jacks connected to each IC pin. It is then very easy to make connections to each IC pin using jumpers or test leads. Another device which could be used for the same purpose is the IC test jig made by EL Instruments and also by API.

The other device is called a Digi-Viewer, which was described in a Popular Electronics article some years ago, and which is now available in kit form from Southwest Technical Products. It is simply a box with 16 bulbs (mounted in two rows of 8), a small power supply, and sixteen amplifiers, which is connected by a 16-wire flat cable to an API IC clip. This is a connector in the form of a clamp, which slips over a DIP IC and makes a connection to all 14 or 16 pins of the IC at once. In this way the box connects to an IC, and the 16 bulbs then monitor the logic level of all the IC pins at the same time. This device is suitable for digital ICs only (RTL, DTL, or TTL), and though it looks useful, we have found that this particular job of identifying unmarked ICs was virtually the only time we used it. To make sure that the bulbs do not load down the IC under test, each bulb is driven by a Darlington amplifier, as shown in Fig. 1.

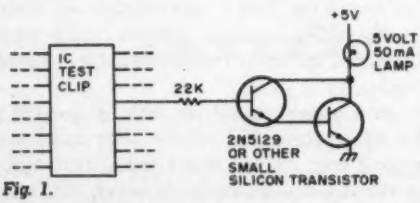

Fig. 1.

The last piece of equipment was a 5V regulated power supply.

The first job in identifying these ICs was to find which pin is the ground connection and which is the +5V pin. Most 14-pin 7400-series ICs use pin 7 for ground and pin 14 for +5V, while most 16-pin TTL ICs in the 7400 family use pin 8 for ground and pin 16 for +5V. But there are a few 7400-series ICs which use other ground and power pins, and so I didn't want to apply power to the usual pins for fear of burning out some of the unusual ICs, which are usually the more expensive ones, too.

And so, I came up with the following procedure. I plugged the unknown IC into the test socket, and then plugged the Digi-Viewer clip over the IC. I also connected the Digi-Viewer ground lead to the ground side of the +5V power supply, but made no other connections. Since the IC has neither a ground nor a +5V connection at this point, there can be no voltage on any pin, and therefore all lights on the Digi-Viewer are off. Now take a test lead, connect one end to the positive side of the +5V supply, and touch the other end to each pin of the IC, one after another. When you connect +5V to an IC pin in this way no destructive current can flow through any pin, since all pins are floating except for the 22K base resistors in the Digi-Viewer (remember, there is no ground connection to the IC as yet).

Interesting things happen when you start touching the +5V lead to the various input, output and power leads. The TTL inputs are applied directly to emitters of NPN transistors, so applying +5V to the emitter reverse-biases the base-emitter diode and no current flows. As a result, no current gets through the IC to the other pins, and all the lights on the Digi-Viewer (except the one which connects to the pin you are touching) remain dark. For the same reason, touching an output pin also reverse-biases some junctions, and again all lights except one stay dark. But touch the +5V lead to the IC ground pin or to the $V_{CC}$ pin, and all the

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Digi-Viewer lights connected to active IC pins go on! Only defective pins or pins with no connection show a dark lamp. This is because various sneak paths exist through forward biased diodes and resistors within the IC from the $V_{cc}$ and ground pins to all of the normal input and output pins.

So here we have a simple test to identify the ground and +5V ($V_{cc}$) pins of the IC; we still don't know which is which, but that is easy. If we find that the live pins are 7 and 14, or else 8 and 16 for 16-pin ICs, then the answer is easy since these two connections are standard. If the two live pins are some other combination, just look through your TTL catalog until you find something similar. In fact, there may be only one device with the particular pair of pins used for power and ground, in which case you have just made an important discovery.

The next step is to find out which of the remaining pins are input pins and which are the output pins. We start by applying full †5V power to the IC, still keeping the Digi-Viewer connected. At this point, some of the tester lamps will light; some of these may be connected to input pins and some to output pins. An important characteristic of TTL ICs is that any input pin with no connection to it is assumed to be at a high level (logical ONE, or about +3 to +5V, enough to light its Digi-Viewer bulb). Hence, every input pin will cause its associated bulb to light, as will some outputs. Take a 330Ω resistor and connect from ground to each of these pins having a 'high' level lighting a bulb. If the pin is an input pin, the 330Ω resistor will load it down enough to make the light go out. On the other hand, output pins are generally 'active-pullup.' meaning that an on transistor is used to make them go positive. Hence a 330Ω resistor to ground will not substantially change the voltage, and the bulb will stay lit.

This test will usually find all of the ICs input pins, and also some of its output pins. For instance, as you ground the input pins with the resistor, you may suddenly find one of the dark lights going on – this must then be an output which comes on when an input is grounded. If the light goes dark again when you remove the 330Ω resistor, then most likely you have a NAND gate of some sort; if it stays on then you probably have a flip flop of some kind. So at this point you can start to make all kinds of guesses about what kind of an IC you have. (But some kinds of outputs – so-called open-collector outputs – are hard to find since they do not have any pullup. You find these by trying a 1K resistor from suspected output pins to +5V.)

Having thus separated the input pins from the output pins, we simply connect various combinations of grounds to the input pins and watch the outputs. We use grounds, since as we mentioned earlier, a no-connection to an input is the same as a high or ONE level; hence we must actually ground an input to force it to a low or ZERO level. In some cases, just knowing which are the input pins is enough to identify the IC; in other cases we have to do a little experimenting and guessing. Most TTL gates are NAND gates, whose output goes high (lighting the bulb) whenever any one (or more) of the inputs is grounded; these are very easy to spot and identify. Inverters are also easy to find since their output goes high whenever the input is grounded. NOR gates are harder since you must ground both inputs before the output goes high.

Flip flops are sometimes hard to find, but with patient digging you can be 100% successful here too. Most will toggle (though not reliably) when you ground and un-ground their T input; this identifies the T input and also finds the two outputs. Then try to find the set and reset inputs; once you have these you should be able to identify the IC by leafing through your TTL catalog.

The hardest ICs to spot are the complicated ones. Most ICs you get in the bargain bag are SSI (small-scale-integration) meaning that they are simple ICs containing at most a couple of gates or flip flops. Don't expect to find many MSI (medium-scale-integration) ICs, and give up on LSI (Large...) ICs altogether, since they usually come in larger packages. I did get some of the 7481 sixteen-bit memories, but failed to get anything really useful like a decade counter, a latch, decoder/driver or something of that sort.

... K2OAW

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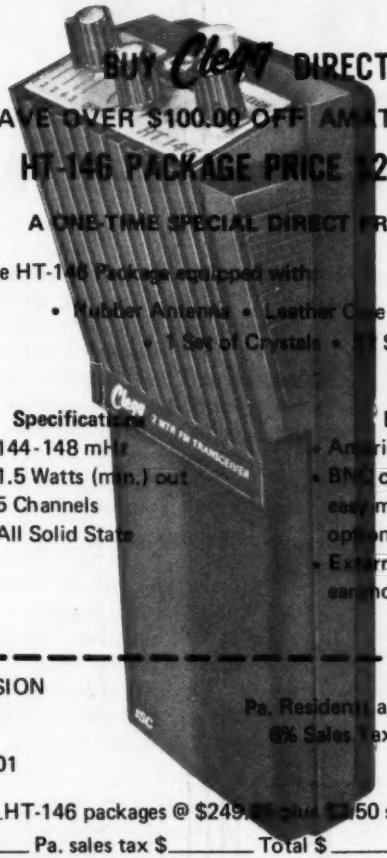

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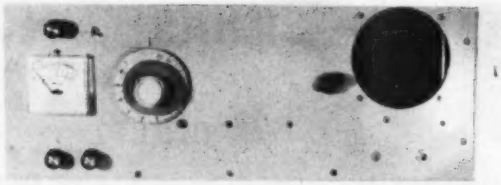

# THE R-511, A REAL SURPLUS BARGAIN

The familiar Command receivers of World War II vintage were unquestionably the single most popular piece of electronic surplus of the post war era. During the Korean war the Aircraft Radio Corporation produced a similar appearing series for use in Army liaison aircraft. Although this article is primarily concerned with the conversion of the R-511 low frequency receiver, the basic power supply will power any of the series.

The most commonly encountered units are:

| | |
|---|---|
| R-511 | 190 – 550 kHz |
| R-22 | 550 – 1500 kHz |
| R-509 | 108 – 135 MHz |
| R-508 | 118 – 148 MHz |

In addition, there are a variety of companion units such as the T-366 transmitter (116 – 132 MHz) and the CV – 431/AR converter for use in the 228 – 258 MHz band.

The equipment differs radically from the World War II series. Loctal and miniature tubes are used, and the circuitry reflects a complete redesign. Also, there are no dials on the units!

The low frequency receiver was converted to fill a variety of needs in my shack. In addition to its use for receiving weather reports, copying marine CW traffic and monitoring the 500 kHz distress channel, it finds use as a selective i-f strip and as a piece of test equipment when working with surplus mechanical filters.

The first step is to construct the power supply as shown in Fig. 1. There are two versions of the receivers, one for 14 V input,

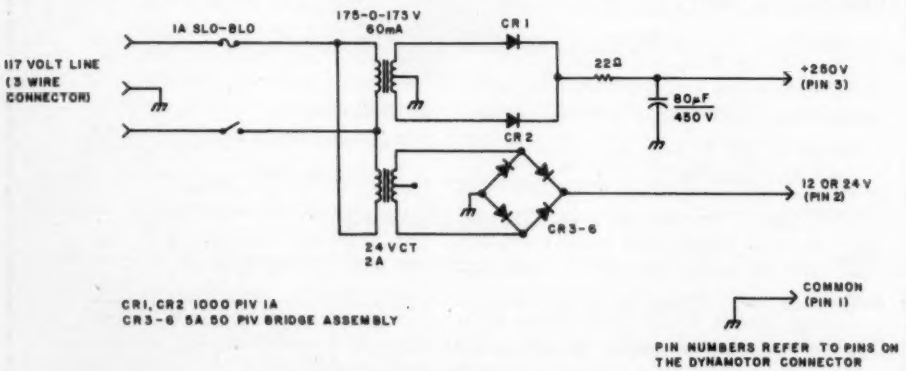


*Fig. 1. Command set power supply.*

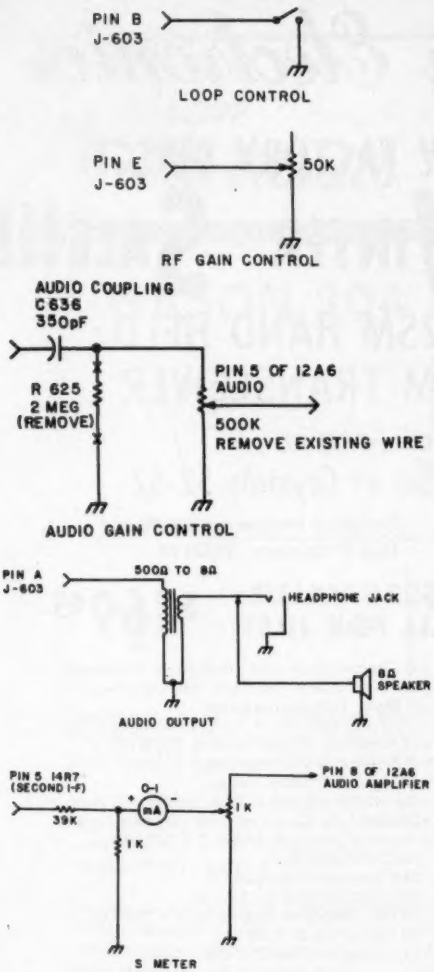


*Fig. 2.*

the other for 28 V input. Set the tap on the filament transformer for the desired voltage. Although ac can be used on the filaments, use of dc results in lower hum levels, and permits operation of the antenna switching relay in the R-511 without any rewiring.

The next step is to connect the gain control from pin E of J-603 to ground. Make sure that there is a jumper between pins A and E of J-606. This is the connector that is in the spot the dial used to occupy. On the VHF receiver, the gain control is connected from pin E of J-302 to ground. In addition it is necessary to jumper pin B of J-302 to ground. This is the cathode resistor of the last af stage. The receiver can now be checked out. Headphones are plugged into the Tel jacks. A temporary tuning shaft can be made by prying the eraser out of a pencil and forcing the metal sleeve over the tuning spline.

Once the receiver is operating the dial assembly can be installed. The best approach is to obtain a Jackson planetary drive. Remove the housing from the tube compartment, and discard it. Remove the shield from around the tuning capacitor. Next remove the triangular shaped plate from the worm gear assembly, and the worm drive. This requires driving out the small drift pin with a punch. The planetary drive is simply mounted on the ¼ inch shaft of the tuning capacitor. The set is then mounted to a standard panel as shown in the photograph.

Final conversion consists of the addition of a speaker, S meter, audio gain control and antenna control switch. The circuit modifications for these additions are shown in Fig. 2. The audio gain control is essential for two reasons. First for the S meter to operate properly the rf gain control must be kept set at maximum, so provision must be included to control the volume. Secondly, by having separate rf and af gain controls the operator can adjust for optimum signal to noise.

**Table 1 Plug Connections**

| Power Input Connector | Pin | Function |
|---|---|---|
| J-301 or J-602 | A | + Low Voltage (14 or 28V) |
| | B | Ground |
| **Control Connector** | | |
| J-302 or J-603 | A | Headphones, 600 Ohm |
| | B | Loop relay (LF receivers) AF Cathode, VHF receivers |
| | C | Ground |
| | D | + Low Voltage |
| | E | Sensitivity (rf gain control) |
| | F | Low Voltage from power input connector |
| **Accessory Unit Connector** | | |
| J-303 or J-606 | A | High voltage to receiver |
| | B | Headphones |
| | C | Ground |
| | D | + Low Voltage |
| | E | + High voltage from dynamotor |

Note: Consult TM 522-22 for VHF sets, AN 16-45-122 for LF sets.

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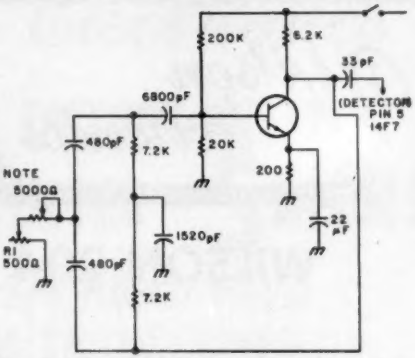


*Fig. 3. Adjust for 85 kHz output with R–1 set to midpoint.*

The R-511/ R-11 series incorporated a noise limiter at the expense of the bfo. Since a bfo is essential for most of my work I incorporated the circuit shown in Fig. 3. Provision for shifting the bfo frequency from the front panel is provided by R-1.

The above conversion is readily done in a few hours time, resulting in a compact high quality receiver at a modest price.

. . .W6JTT

## MAKE YOUR OWN AIR CORE COILS

Air core coils wound with small diameter wire are often very hard to keep mechanically stable. Here is a simple method that I have used many times to reinforce small home brew coils.

Take your newly wound coil and momentarily connect it across a 12 V car battery charger. Hold it across the battery just long enough for the coil to reach a temperature that will melt plastic. It only takes a few seconds, so be careful not to over heat the coil.

Now, with your other hand, take one of those readily available clear plastic coffee stirring sticks and melt it into the coil turns by holding it flat against them. Let it cool and trim off the excess plastic. With a little practice you can make very professional looking coils in a matter of a few seconds.

. . . VE3FEZ

*Elliott Kanter W9KXJ*
*3242 W. Hollywood Ave.*
*Chicago IL 60645*

# THEFT, THE HAM and HOW NOT TO BE A LOSER!

The new car pulled into the old-timer's driveway, and a very youthful lad hopped out.

"Hi, did you copy me ok on the way from the dealer?"

"Sure did, young fella, just how much gear have you got in that car?"

The lad opened the door wide, and the old-timer noted a first-rate transceiver, power supply and swr bridge mounted beneath the dashboard. "Tommy, you've done a real good job of installing your equipment, but have you given any thought to protecting it?"

"What do you mean? I've fused all the lines and made sure that I installed ignition bypass capacitors."

"Tommy, that's not the protection I had in mind. I figure you've got maybe six hundred dollars worth of ham gear in the car – have you got that investment protected?"

"I'm not sure . . . maybe I should install a burglar alarm or something . . . "

"Tommy, it's that 'or something' that you should pay attention to. With an investment as large as yours, you should do more to protect it than just install a burglar alarm or keep the doors locked. Come on inside – we'll have a cup of coffee and I'll explain what I mean – don't forget to lock the car, first!"

The two hams entered the house and sat at the kitchen table. The old-timer brought out a pencil and paper along with two steaming cups of coffee.

"Tommy, the first thing any ham should do when he installs his equipment anywhere is to record all of the serial numbers and put this list away in a safe place, together with the bill of sale for the equipment. Second, let's take a look at your auto insurance policy. Do you have it in the car?"

"Yes, wait one and I'll get it."

While Tommy went for the policy, the old-timer stoked his battered pipe and waited.

"Here she is."

"Ok, let's look at the fine print – seems like you are covered for property damage, liability, collision and uninsured motorist . . . hmmm, that's in order . . . but let's take a long look at your fire and theft policy. Good! Just what I was hoping for – you've got comprehensive."

"What's that mean?"

"Basically, Tom, that means anything firmly affixed or attached to the car as an accessory will be covered for fire or theft. A lot of times people don't take the comprehensive theft package, and when something

happens they find that they weren't insured for their losses. It might not be a bad idea for you and me to load up my Polaroid and take a ride down to Mr. Jones' office, who is a notary public."

"Any special reason, old-timer?"

"Yes, one of the best – now would be the best possible time to establish that the equipment is really firmly mounted in your car."

"Ok, I'm game, but why do we need a notary and a Polaroid?"

"What we will do is shoot a number of photos of the equipment installed in your car in the presence of Mr. Jones. He, in turn, willl note on the back of the photo that he observed the equipment mounted in your car and will verify the serial numbers, and apply his seal over the whole works. This will establish proof that the equipment is mounted in your car and that the serial numbers agree. In case of loss, this becomes valuable proof for you when you submit a claim to your insurance company."

"Old-timer, you're putting me on. This seems like a lot of unnecessary work to go through. I always lock my doors and never leave the keys in the car!"

"Tom, come on downstairs, I want to show you something."

They went down to the old-timer's workshop, where on top of a shelf was a bent transceiver mount. The old-timer blew the dust off it and set it down on the bench.

"Tom, this is all I have left from the six meter rig I used to have in my car. I locked my doors, and wasn't away more than five minutes, but when I returned, the vent window had been sprung, and the rig, my car radio, and a jacket were gone."

"Ok, I'm sold, let's go over to Mr. Jones' office and get it over with!"

Theft of amateur radio equipment and audio accessories is on the increase. In order to protect your investment, record your serial numbers, have proof of installation, and be sure you have insurance coverage – either a comprehensive auto-theft policy – or maybe one of the homeowner's insurance policies that cover personal belongings . . . and always remember to lock your car and take the keys with you. . . . W9KXJ

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*Howard F. Burgess W5WGF*
*1801 Dorothy Street N.E.*
*Albuquerque NM*

# An Incredibly Versatile Transistor Checker

**Build this tester, amplifier, oscillator, etc.**

Transistors have been around long enough to become obsolete but the manufacturing processes still seem to be a bit unpredictable. A little study will show that two transistors carrying the same number and both from the same manufacturer, can differ by as much as 1000%.

With this spread there is no end to the variety of units you could get under a single type number. To an old tube man this is like putting the same number on 6L6's and 6AQ5's.

While variety can be the spice of life it can certainly foul things up if you are planning to design a new circuit or if you are trying to change a transistor in an old one. You can design a circuit right by the book and then find that even though you purchased the correct type of transistor it will not work with your values.

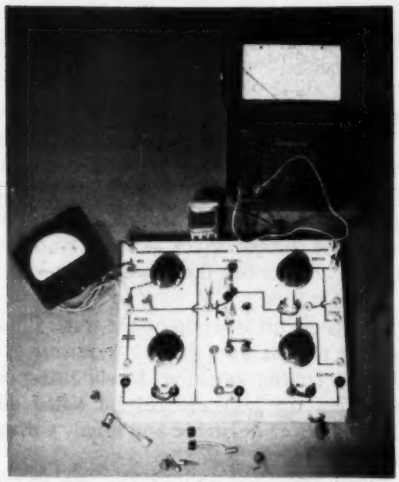
I became a little tired of trying to out guess the specs so I built a little gadget to do the work for me. I call it the "second-guesser." It not only helps solve design problems but it is also an interesting learning device for those who are just getting acquainted with transistors. It can also be used as a transistor tester, a complete one stage amplifier, or as an oscillator. With a little care and attention it might be trained to do other chores around the place.

### How It Works

The unit is really an in-circuit tester. It is a tester to check the operation of a particular transistor in a circuit similar to the one you plan to use later. When we built the tester we wanted it to be versatile, but it also had to be simple. So we built it as a small patch panel type of substitution board. With the patch system you can mock up or duplicate almost any circuit in a matter of seconds with only four variable resistors, two capacitors and a handful of phone tip jacks.

When a new circuit has been set on the tester and has been adjusted for the desired operating characteristics, the current and

voltage can be read at any point in the circuit by using the tip packs. The resistor values selected can be read from the dial settings. After correct current and component values have been determined with the mock-up, it is safe to assemble a firm circuit. This method can also save printed circuit boards from many of the hazards of



*The meters can be any of a suitable range that happen to be around.*

cut-and-try changing of parts. The same method will work to determine bias values when a replacement transistor must be installed in a piece of existing equipment.

Most transistor circuits can be simplified to one similar to the one shown in Fig. 1. The operating characteristics will be determined by the values of resistors A, B, C and the load L. Operation of the circuit can also be influenced by interaction of resistor values and transistor characteristics.

In some circuits A, B, C and L will all be used, but in other cases one or more resistors may be missing. The problem is to determine the values to use that give the results you want from a particular transistor you plan to use.

The circuit of the tester is shown in Fig. 2, and it was designed around the basic circuit of Fig. 1. The tip jacks make it possible for additional circuit elements to be added if they are needed. In addition the

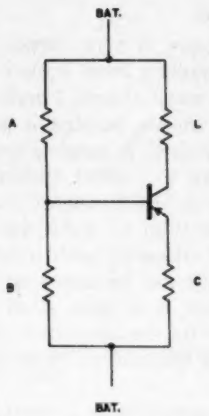



*Fig. 1. Most transistor circuits can be simplified to one similar to this.*

jacks make it possible to take voltage and current readings at any point in the circuit. The resistors A, B, C and L are variable and were selected to provide the most used values. If special sizes of resistance are needed they can be added with tip and clip leads.

The load L can be either the internal resistor or it can be an external resistor or transformer plugged into the proper jacks. Adding the input and output coupling capacitors makes the unit a complete one-stage amplifier for special tests or experiments. The connections to the transistor under test are also brought out to tip jacks. This makes it possible to use various clip arrangements for the many types of transistor connections.

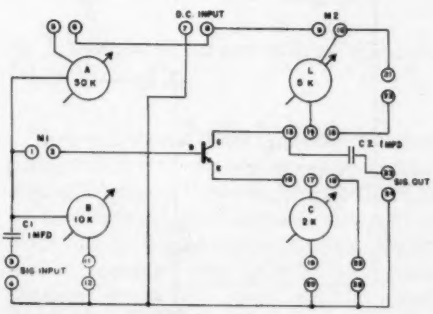



*Fig. 2. The tester circuit shown here is designed around the basic circuit of Fig. 1.*

## Construction

Construction is very simple. It can be built on anything from a piece of pressed wood to a metal chassis. I prefer the metal chassis, as shown, because it provides for better grounding. A good ground is sometimes needed to prevent oscillations which show up with high frequency transistors. It was a temptation to make the entire unit quite small. However with a larger chassis the schematic can be drawn on the top. If the schematic is in view at all times it is much easier for the operator to visualize the circuit while the patches are being set up for a new idea.

Short patch cords or jumpers were made from flexible wire and phone tips. These cords are used to complete the circuit when external connections are not being used. Wire-wound variable resistors are used for better stability and power rating. The knobs are calibrated so that approximate resistance values can be read directly. If an accurate value of resistance is needed, the little jumpers can be removed and the resistance read direct from the jacks with an ohmeter or bridge.

The chassis was given a coat of light-colored automotive touch-up paint from an aerosol can. The schematic was put on with a wick tip pen; however very narrow black tape can be used. If high frequency transistors have a tendency to oscillate, it may be necessary to bypass the leads close to the transistor with mica or ceramic capacitors.

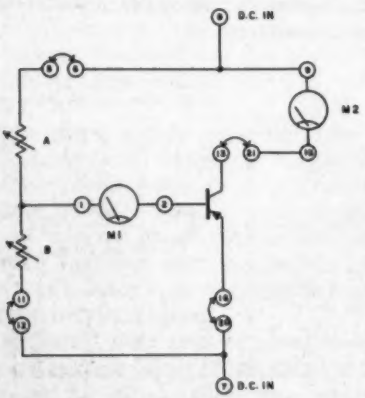
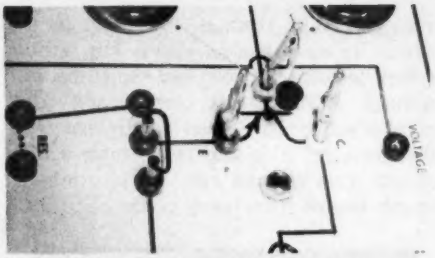



*Fig. 3. A simple transistor test circuit.*



*Clips soldered to phone tips will hold almost any transistor.*

## Operation

Operation of the tester is simple. With the schematic spread on top it's like playing an electronic game. You need only a basic circuit in mind and you are in business. We don't have enough space to cover all of the possible circuits but the schematic in Fig. 3, is a good starter.

If this circuit is set up on the tester it can be used to find the gain of a transistor as a common emitter amplifier. It will also show the effect on gain and current when different values of resistance and supply voltage are used.

Many other test circuits can also be put together by referring to a transistor manual or text.

In all of the schematics the numbered circles represent tip jacks, and the curved arrows between them indicate that a jumper is plugged in. The meters can be any of suitable range that happen to be handy. All jumper connectors should be in place and the circuit complete, with the transistor, before the supply voltage is connected. Always be sure that resistor A is at maximum resistance and that resistor B is at minimum resistance before power is applied the first time for any new set up. With the resistors in this position the currents will be minimum. Increases in current should be made slowly and monitored with the meters.

If the transistor being tested is a PNP, connect the supply voltage positive to jack 7 and the negative to jack 8. If the transistor is NPN, connect the supply negative to jack 7 and the positive to jack 8. Base and collector currents can now be set to desired values by adjusting resistors A and B slowly. The gain or beta will be the ratio of the base current

to the collector current. This is the dc gain factor. If the ac or dynamic gain of a transistor is needed the next circuit may be of help.

When the jumpers are placed as shown in Fig. 4, the tester becomes a complete one-stage resistance-coupled amplifier. It is useful in finding the values of resistance, voltage and current to use with a particular transistor and to find the ac gain of a transistor-circuit combination. A signal can be fed to the input and compared with the output signal while adjustments are being made. It is useful for finding the dynamic gain and for checking out the "grab-bag" variety of transistors. It is also nice to have when substitutions must be made.

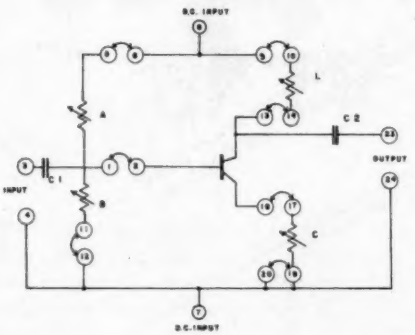



*Fig. 4. The tester is now a one stage amplifier.*

The circuit of Fig. 5, is almost the same as the one in Fig. 4, except the load resistor has been replaced with an output transformer. This can be used to simulate or design audio output stages.

With a little practice all sorts of amplifier and oscillator circuits can be arranged. However, in its present form the top frequency is probably limited to a few megahertz. This could be increased somewhat with careful layout and construction.

Those who are interested in other types of solid state devices such as SCR's and unijunctions will also find the gadget useful. It can be used for unijunctions as shown in Fig. 6. This circuit will oscillate at a frequency determined by the combined value

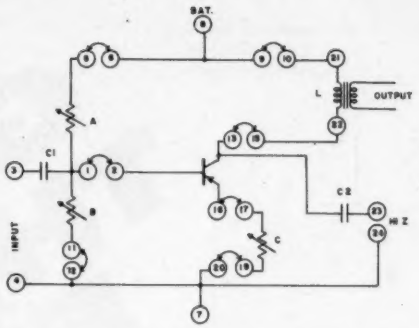



*Fig. 5. Still a one stage amplifier, but with a transformer output.*

of resistors A and X and also whether a jumper is placed between jacks 3 and 4. Another capacitor can be placed in series with C1 to increase the frequency. Variations of the circuit can be used for both testing and sorting controlled rectifiers and unijunctions.

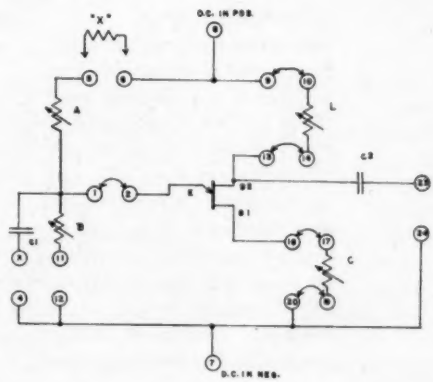



*Fig. 6. Unijunctions and even SCRs will operate in this one.*

This is a simple tester requiring very few parts, but it is a very handy gadget to have around the shack. However, don't be mislead by its simplicity. Any ingenious ham with a truckload of surplus can expand this device into a monster with flashing lights, and clicking relays — even built-in "self-destruct."

...W5WGF

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# SSTV Video Analysis of TV Signals

In order to produce pictures of high quality a slow scan camera must be carefully adjusted so that its audio frequency output matches the standards for slow scan picture transmission. Synchronizing pulses are transmitted as bursts of 1200 Hz while video information is transmitted by varying the audio subcarrier from 1500 Hz for black to 2300 Hz for white. Frequency values between these two limits will be reproduced as varying shades of gray.

It is highly desirable to be able to evaluate the video frequency components of a slow scan signal, both for proper adjustment of your own camera and to provide useful reports to other slow scanners on the status of their own camera systems. If the camera subcarrier does not "swing" through the entire video range when both black and pure white values are present in the scene being televised the result will be a picture lacking in contrast that will be either too dark, too light, or just washed out. The wide availability of frequency counters makes it relatively easy to set up the camera for precisely 1200 Hz output during sync pulses but the actual video range obtained during day to day operations can be quite variable when lighting and subject matter are constantly being changed. Constant juggling of monitor contrast and brightness controls can often make the display on your own monitor somewhat subjective in evaluation of video quality since even a poorly adjusted camera can be made to yield passable pictures if you're willing to constantly play with the monitor.

An objective evaluation of the video frequency output of cameras can be had using a spectrum analyser such as the one described by WØLMD (73 SSTV Handbook) but that approach requires the construction of a separate unit strictly for video analysis. The approach to be described here permits real-time line by line analysis of the video excursions of the SSTV signal using the normal station monitor and as few as two additional components—would you believe a switch and a capacitor?

**How It Works**

Addition of the video analysis mode to the SSTV monitor is based on the fact that many of the commonly used monitors

employ a single sided video discriminator circuit whose output is an amplitude "modulated" signal whose amplitude is directly related to the audio frequency of the signal at any moment in time. Since the incoming SSTV signal has been limited prior to the discriminator, the output of the discriminator is a faithful representation of the frequency excursions of the incoming signal that is independent of the contrast and brightness settings of the monitor. All that is required is to provide a convenient way of displaying the amplitude variations in the output of the discriminator in order to evaluate the slow scan signal. In principle all that is required is to first break the continuity of the video signal at any convenient point so that the monitor trace has a constant brightness and second, to feed a sample of the discriminator output into the monitor vertical amplifier after the normal ramp generator circuit has been disabled. Fig. 1, shows the modifications in my own monitor (*73 Magazine, August 1973, p. 45,*) to accomplish this. One half of a DPDT switch is used to disable the video amplifier (Q3) in the analysis mode. The other side of the switch connects the input of the vertical deflection amplifier to the vertical ramp amplifier in the normal monitor mode but switches to a capacitor connected to the video discriminator (L1) in the analysis mode. In the normal "monitor" position the monitor operates normally while in the "analysis" mode the amplitude variations in the discriminator output are displayed on the vertical axis of the crt. A synched horizontal scan is maintained during analysis. Since the discriminator is tuned to 2300 Hz, the baseline of the display represents this frequency. A portion of the 1200 Hz horizontal sync pulse will appear at the beginning or end of the horizontal trace, depending upon how the monitor is triggered. The peak deflection during the sync pulse provides a 1200 Hz reference level. Black, as 1500 Hz, will have a peak value slightly less than the 1200 Hz reference.

This basic idea can be used in any monitor incorporating a single sided discriminator. This includes the WB8DQT, Macdonald, W9LUO (QST, March 1970)

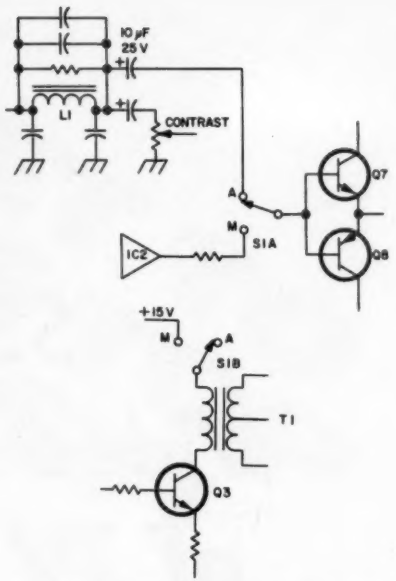


*Fig. 1. Modifications of the WB8DQT monitor circuit to incorporate video analysis. S1, a DPDT switch and the 10mf capacitor are the only additional components required. The remaining components illustrated are part of the original circuit and are included to enable the circuit additions to be oriented in relation to the entire circuit. S1A functions to connect the output of the discriminator to the input of the vertical deflection amplifiers while S1B breaks video continuity during analysis. M on the switch terminals indicates the normimal monitor mode while A indicates the new analysis mode.*

and W4TB circuits (73 SSTV Handbook). Monitors such as the W6MXV with its pulse counting discriminator and the Robot circuit with an "S" shaped discriminator response will not drive the vertical amplifier directly but this idea can be incorporated if an additional 2300 Hz tuned circuit is connected to the input limiter as indicated in Fig. 2. Video continuity may be broken at any convenient point in any of these monitor circuits or the video contrast control may be backed down to minimum gain during analysis to yield a trace of constant brightness. This latter approach is not nearly as convenient as breaking video continuity with the same switch used to route the discriminator output into the vertical deflection amplifiers.

## Using the Video Analysis Mode

Fig. 3 shows drawings of typical video displays from different types of slow scan pictures. Depending upon where your monitor triggers, a portion of the horizontal sync pulse envelope will be visible at the beginning or end of the horizontal trace. The amplitude of the sync pulse envelope provides a 1200 Hz reference. 2300 Hz will fall at or very near the baseline of the display. In order to accurately analyze the video signal the receiver tuning must be accurately set for proper carrier insertion.

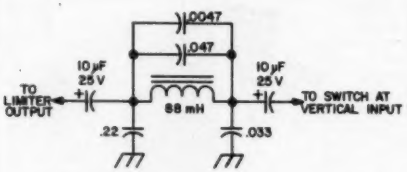


*Fig. 2. Addition of a single-sided discriminator to monitors of the W6MXV and Robot type to provide a display signal to the vertical deflection amplifier. The rest of the switching logic would be similar to that illustrated in Fig. 1.*

Monitors such as the WB8DQT and W6MXV provide built in tuning indicators for this purpose. The use of an outboard or add-on indicator of the type described by K7YZZ (73 SSTV Handbook) is almost essential for accurate results with monitors which do not incorporate a tuning indicator.

Since noise or QRM falling within the signal passband will also be displayed, critical evaluations can only be made with relatively clean signals. It is also important to realize that there are only a few cases where we should expect a signal to shift completely from 1500 to 2300 Hz. These include station call signs (black letters on a white background and vice versa) and line drawings. If the camera is properly adjusted and the lighting is reasonable, the signal should swing through the entire video range. If it doesn't then some additional adjustment is in order. Normal photographs and well lighted live shots can normally be expected to hit 1500 and 2300 Hz at some point in the picture but cannot be expected to shift this much in every line—it depends on the type of picture being transmitted.

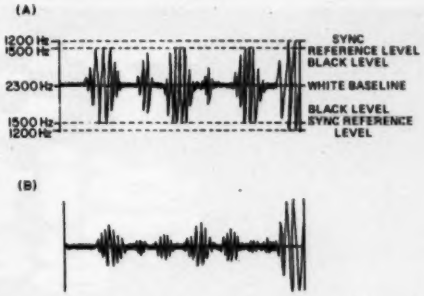


*Fig. 3. Typical CRT displays in the video analysis mode. The two fixed reference points are provided by the baseline (2300 Hz) and the peak deflection noted during the horizontal sync pulse interval. (A) shows a display from a well adjusted camera viewing a black and white scene such as block letters on a white background or a line drawing. (B) shows a display where the subcarrier does not swing the full video range but rather is limited to excursions in the white and mid-range gray region. If the picture reproduced here were similar to that in (A) then camera readjustment would be called for. A well adjusted camera on the other hand will produce such a display when scanning a portion of a picture that consists primarily of whites and grays.*

Wobbling sync pulses due to multipath propagation will be clearly visible on the display as will any video transients. Highly clipped video will often show some transients in the zone between 1200 and 1500 Hz providing a visual indication of why such signals may often sync erratically, particularly when noisy.

The purpose of the video analysis modification is to provide a useful tool, not to make everyone a video nitpicker. The wide variation in monitor brightness and contrast settings often enable a newcomer to SSTV to view a picture that is actually of very poor quality. The use of video analysis as a tool will enable you to assess the performance of your own camera system as well as providing constructive advice to other operators regarding their own gear.

In summary, this simple modification will enable you to view the line by line video excursions of slow scan signals. The display is fascinating to watch so remember to switch back and view the actual picture every once in a while!

**... WB8DQT**

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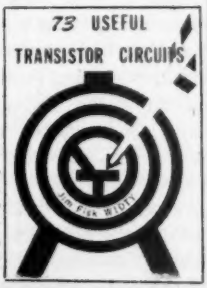


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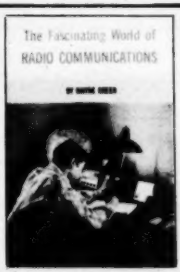


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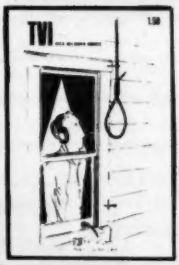


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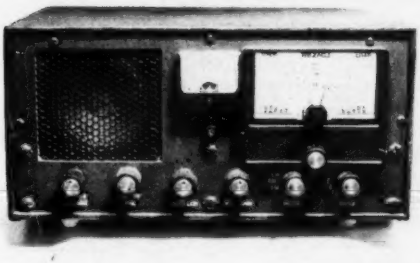
# Build this All-Band VHF Receiver

*David M. Eisenberg WB2AGJ/2*
*295 Home Street*
*Teaneck NJ 07666*



Pity the VHF nut!

Unlike the HF operator whose equipment may span four, five or even six bands in one box, the 50MHz and up man too often finds his shack full of metal enclosures, yards of coax, switches, etc., etc. Even the one VHF band operator now faces the dilemma of the modern age; should his gear be compatible with AM, FM, NBFM, CW or SSB?

I, motivated by a desire to expand his coverage of the bands above 30MHz and prompted by the virtual non-existence of commercially manufactured multi-band, multi-mode VHF gear, nobly embarked upon the lifetime project of a solid-state station for 6 through 3/4m. Since receivers are more difficult than transmitters, and since you can't work what you can't hear anyway, the receiver was done first.

It was deemed necessary that the design criteria for the project follow three objectives. The first was receiver performance characteristics. Sensitivity should be good, noise low, high degree of immunity to cross-modulation, overloading and spurious responses; selectivity should be narrow enough to prevent off-frequency stations from interfering, but wide enough to copy NBFM and drifters.

The second objective was versatility. Since this was to be *the* receiver for all my future endeavors on VHF, it had to work on all popular modes on all the bands with a minimum of controls. Keeping mobile operation in mind, it had to be compact and operate as well on 12V dc as it did on the bench with 110V.

The third consideration was cost. At first I thought of using ICs, since they are compact and inexpensive. However, after experimenting with some 703 rf amps, I decided they were too finicky, too noisy and too difficult to stabilize. The junk box was well stocked with the 50¢ variety of plastic transistors, and, as they lent themselves quite well to experimentation, I began using them.

Based on these factors, the results of the design requirements were a receiver that:

- Covers any two MHz of 28, 50, 144, 220 and 432 with one bandswitch control.
- Receives AM, NBFM, CW and SSB.
- Operates on 117 VAC and/or 12 VDC.
- Measures 28.58cm x 22.86cm x 13.97cm (11¼ x 9 x 5½").
- Looks nice.
- Doesn't break the budget.

**Circuitry**

The basic receiver is a double-conversion superhet which tunes 28-30MHz. Four converters located above the main chassis permit reception on VHF.

The converters are nearly identical to each other (Figs. 1, 2, 3 & 4), each containing a band-pass filter, two rf amplifiers, a mixer and an oscillator or oscillator chain. Grounded-gate amplifiers were used for the rf stages to afford stability without the need for neutralization. T.I. Tis-34s were used for all stages except the rf amps and mixer at 432, which are Motorola 2N5485s.

10m was chosen as the tunable first i-f to keep down images, and with .2μV sensitivity it's a dandy little band to listen to when the ZLs come in on skip. A single grounded-gate rf stage works well here, once again eliminating neutralization schemes.

The H.F.O. is a Vackar and tunes from

22.5 to 24.5MHz. Tuning is accomplished with variable-capacitance diodes (vvc's) which permit tracking and compactness, see Fig. 5.

The 5.5MHz output of the FET mixer is applied to the second i-f which uses AGC-

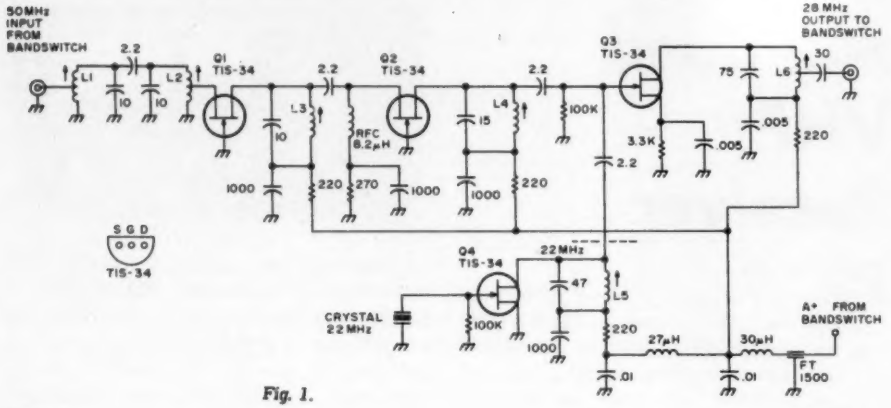



*Fig. 1.*

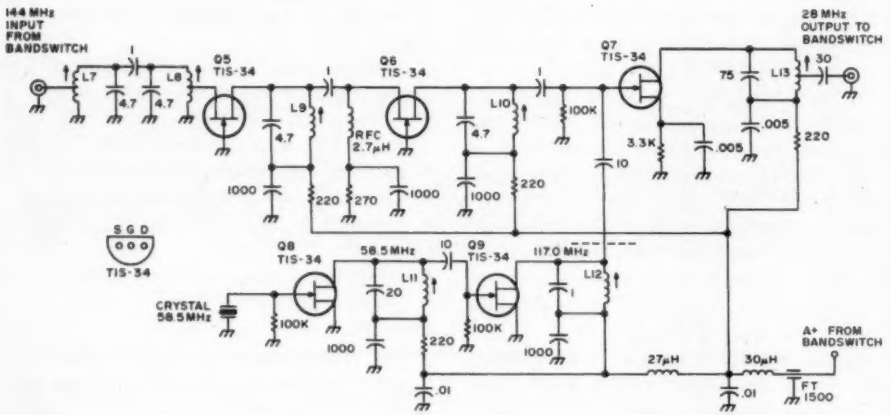



*Fig. 2.*

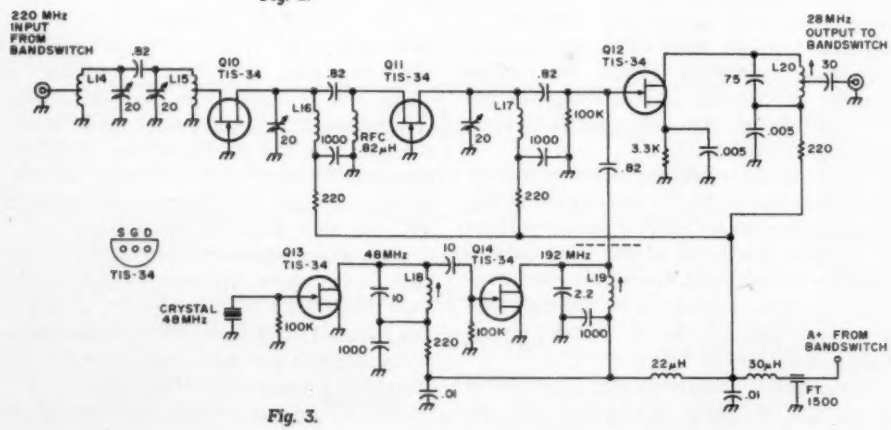



*Fig. 3.*

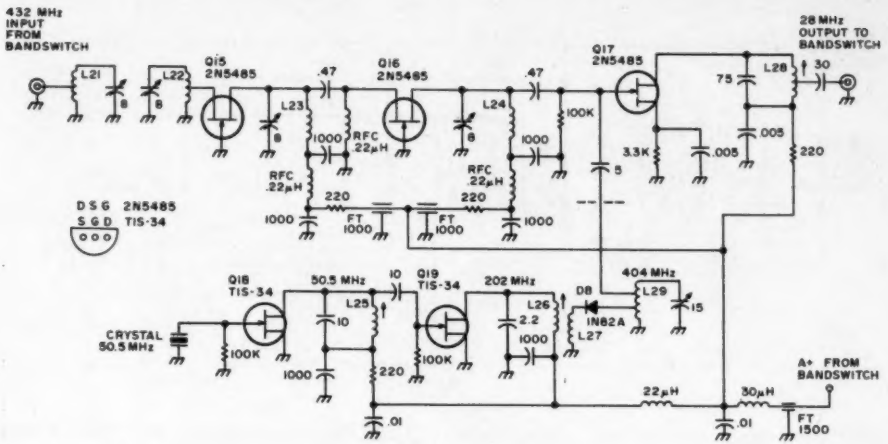



Fig. 4.

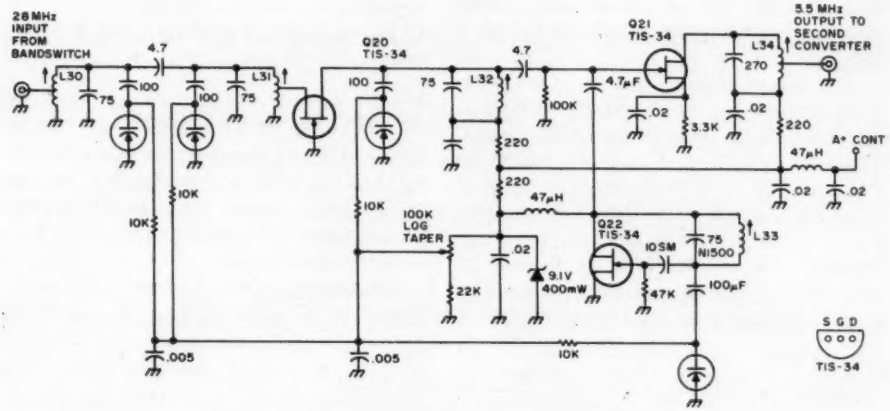



Fig. 5.

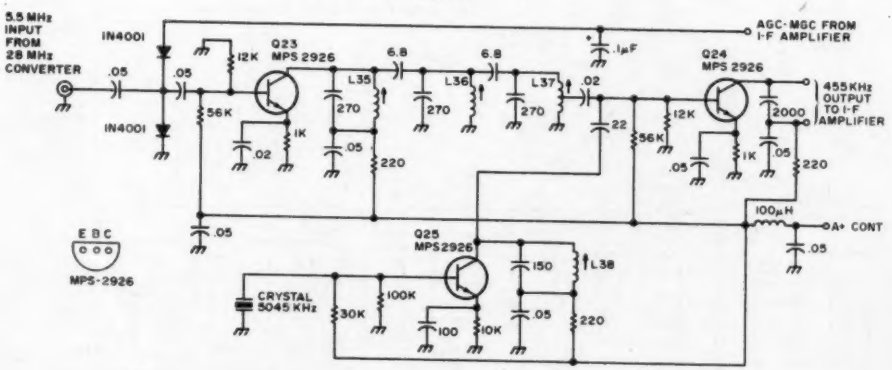



Fig. 6.

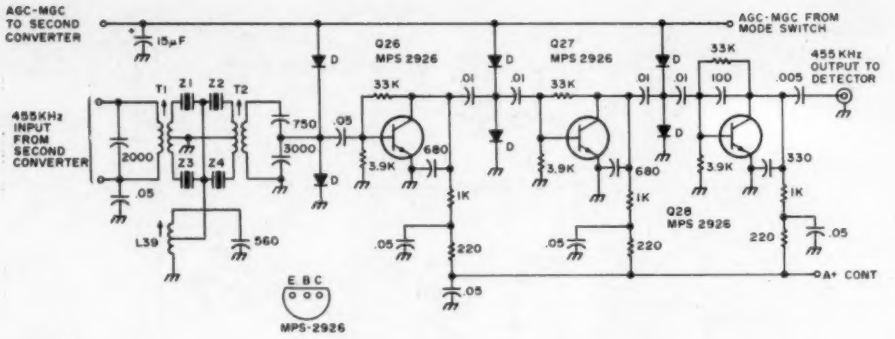



*Fig. 7.*

MGC controlled amplifier and a triple-tuned filter to reduce the chance of overloading the second mixer, whose output is coupled through a 455 kHz ceramic filter to a three stage high gain amplifier, as shown in Figs. 6 and 7.

The use of silicon rectifiers in the interstage networks of the i-f amplifiers results in an economical, wide range AGC circuit. Transistor Q29, Fig. 8, acts as a limiter on FM; on AM it's a 455kHz amplifier whose rf output is coupled to the IN60 AGC rectifier pair, which is connected as a voltage doubler. The resultant dc is filtered to eliminate amplitude variations caused by speech and biases the AGC amplifier (Q33 & Q34) into conduction; the AGC diodes derive their operating bias from these transistors. With this scheme it is virtually impossible to overload the detector.

The output of Q29 is coupled to the detector via transformer T3. The detector is actually a phase discriminator; however, on AM, CW/SSB, the mode switch connects the circuit as a half-wave rectifier. On CW/SSB, the AGC rectifier is disconnected and the AGC diodes receive their bias from the manual gain control potentiometer; the BFO is energized and connected to T3.

The output of the detector is fed to the squelch and audio stages. The squelch is

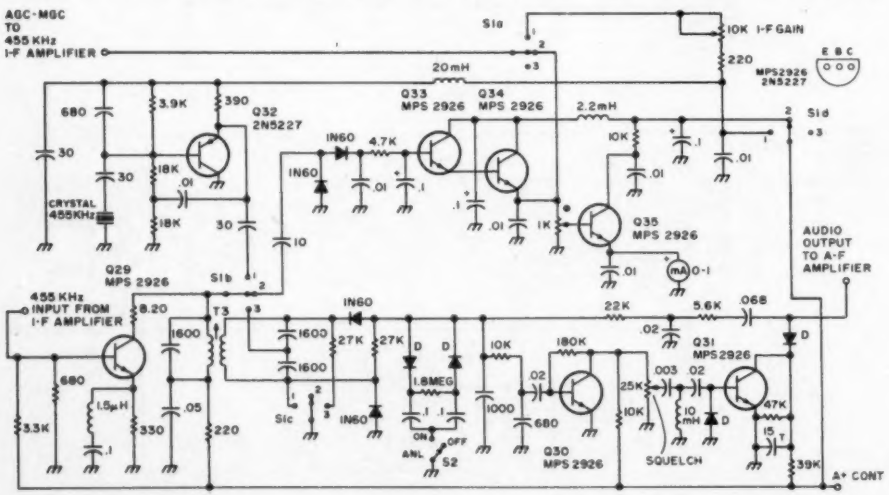



*Fig. 8.*

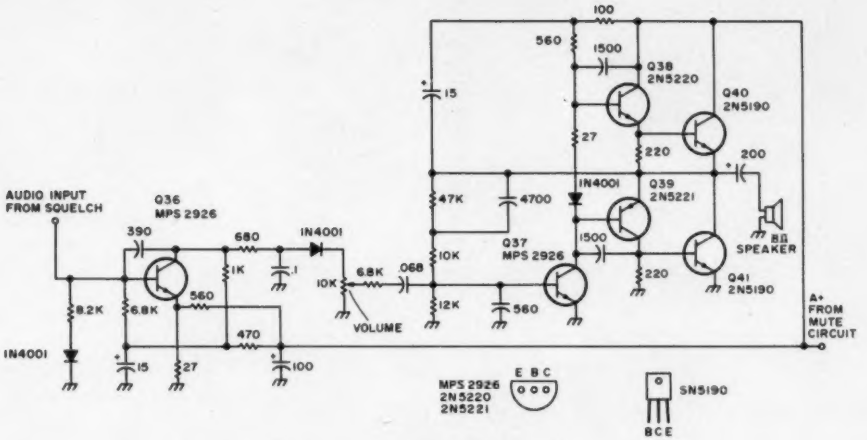



*Fig. 9.*

noise actuated and contains low-pass and high-pass filters to prevent false triggering by rf and/or audio signals. When noise is present at the detector output, Q31, Fig. 8, biases the first audio transistor, Q36, Fig. 9, out of conduction and mutes the speaker.

The audio amplifier is a quasi-complementary circuit operating at about three watts peak output; it runs class AB and is quite efficient if battery operation is intended.

Power for the receiver is obtained from a simple transformer rectifier filter circuit followed by a Zener referenced Darlington pair, which provides 13.6V at 1A. Muting during transmit is accomplished by grounding the base of Q44 through the 2700Ω resistor, which turns off Q45 and kills the A+ to the audio Amp.

**Construction Notes**

Modular construction was employed throughout, as it loads itself to ease of testing and troubleshooting. A standard 17.78cm x 27.94cm x 5.08cm (7 x 11 x 2") aluminum chassis was divided into seven compartments by utilizing "egg-crate" construction under the chassis, which effects excellent shielding and contributes to the receivers lack of birdies.

Printed circuit boards measuring 5.72cm x 7.62cm (2¼ x 3") were used for the main receiver. Layout is generally non-critical, but keeping component leads as short as possible is recommended, particularly above 445kHz.

The front panel was cut from heavy gauge aluminum and attached to the main chassis with spacers to allow adequate room for

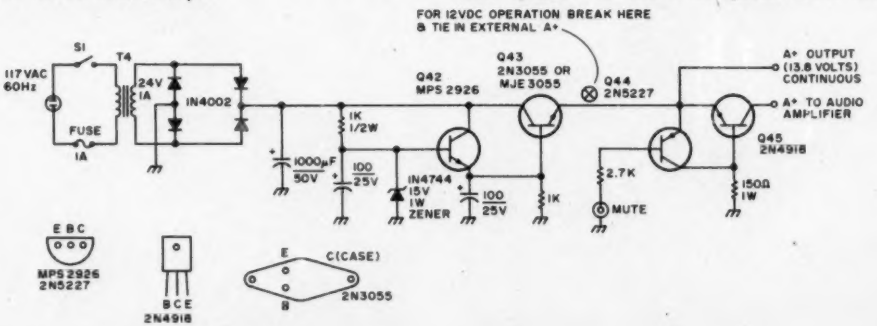
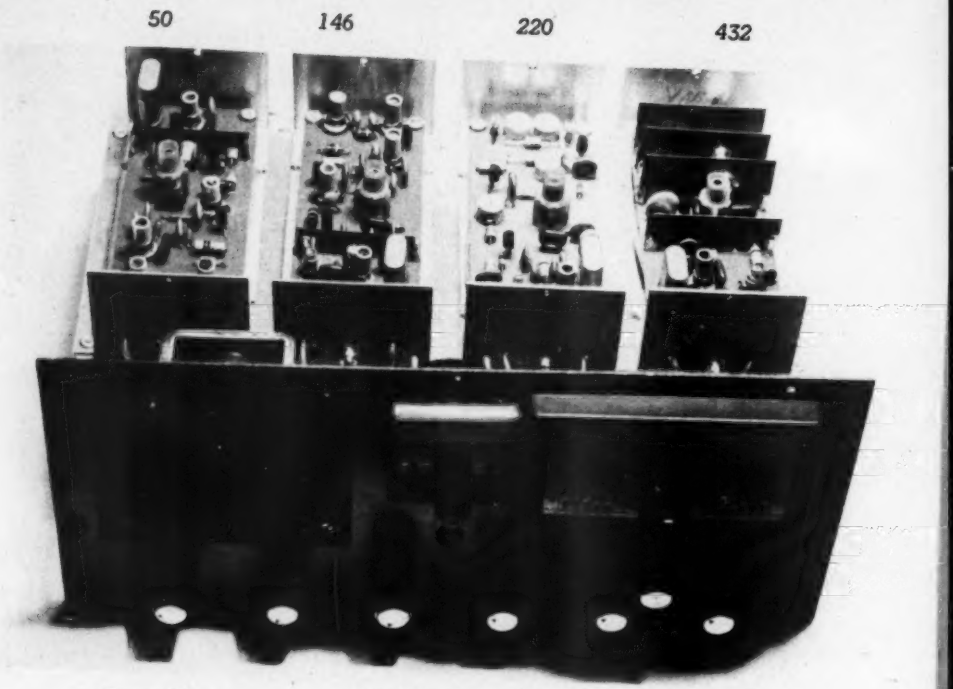
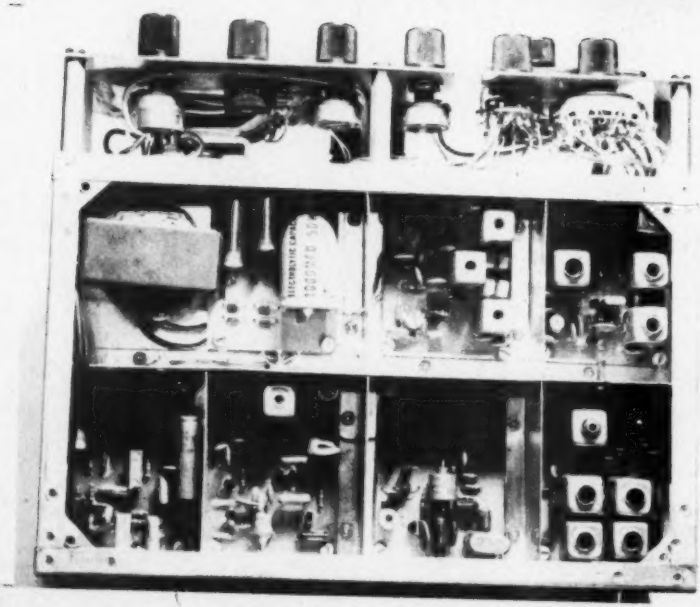



*Fig. 10.*




Power Mute 455 kHz i-f amp. 5.5 MHz conv.



AF amp. Det/Squelch AGC/ANL/BFO 28 MHz conv.

controls.

The VHF converters were built into 13.02cm x 5.72cm x 4.45cm (5-1/8 x 2¼ x 1-3/4") miniboxes and bolted to an alumin um plate, which was mounted above the main chassis. This arrangement permits easy accessability to the converters for alignment, changing crystals, etc.

The converters are fabricated on 11.43cm x 5.08cm (4½ x 2") PC boards; the oscillator chains were placed at one end, the rf stages at the other and the mixers at the center. Shields made of flashing copper separate the oscillator circuits from the remainder of the converter stages, one shield on each side of each board.

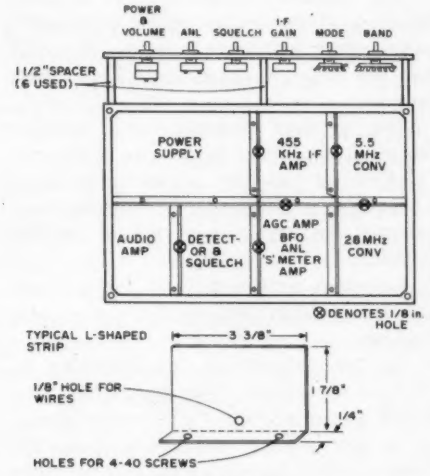


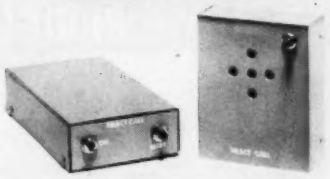

*Fig. 11.*

On the 432 board it was necessary to add shields between the input and the output (source & drain) of both rf amplifiers to prevent oscillation.

Alignment is not tricky. Start at 455kHz and tune the i-f filter and T3 for maximum S-meter reading in the AM mode. Then tune the 5.5MHz converter by loosely coupling a signal generator to the base of Q23. Next, dip L33 to 23 MHz and connect the signal generator to the antenna input connector of the receiver. With the bandswitch set to 10m tune the generator to 28.5MHz and adjust L33 to receive it. Then peak up the 28MHz stages.

Alignment of the converters is easily done


**Select Call**



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by first tuning up the oscillator chains with a wavemeter and then peaking all coils or capacitors.

**Performance**

The sensitivity of the receiver was measured with a calibrated Motorola T-1034C FM signal generator. The 20db quieting sensitivity was as follows:

28 MHz = 0.2μV
50 MHz = 0.1μV
145 MHz = 0.1μV
432 MHz = 0.2μV

The 220MHz sensitivity was measured on an EICO 324 and was estimated to be 0.15μV.

The selectivity is about 10kHz at 60dB which is all that is needed on VHF and is wide enough to follow the drifters (HA-460s and the like) without having to constantly re-tune.

The receiver exhibited no spurious responses, birdies or images on 10, 6 or 2. On 220 and 432 there are some very weak TV images (possibly harmonics); these may, however, be due to my lack of suitable skyhooks on these two bands.

Extensive tests with locals on six have failed to produce cross modulation or overloading.

One word I'd like to add concerning the vvc's in the H.F.O. When the rig was first tested it used a single 25pF variable capacitor to tune and was rock stable. Having the desire to track, the vvc's were installed and a few minutes of warm up drift resulted. If frequency stability is essential, it would be in the best interest of the reader to consider another tuning method, such as ganged capacitors.


The author would like to thank Bud Weisberg K2YOF, for his advice and assistance, as well as encouragement, in getting this bomb together.


**Substitutions**

The TIS-34s can be replaced by MPF-102s or 2N3819s. 2N5486s in the 432 front end will improve the noise figure slighter. Most of the MPS2926s can be replaced by surplus NPN silicon transistor with an FT above 100 MHz.

...WB2AGJ/2

*Andrew M. Cohn K4ADL*
*4823 West Braddock Road*
*Alexandria VA 22311*

# Let's Keep Amateur Radio a Secret

From the depths of exotic jungles to the seamy city streets the old familiar cry echoes through the night, "How come we hams never get any recognition?"

To believe the majority, it would appear that public recognition of our happy sport would bring endless benefits. But when architect Mies van der Rohe first stated that "less is more," he could very well have been talking about amateur radio.

Do we really want or need all the recognition we've been beating the drums for? Maybe so, but just for the sake of some academic fun let's take a tongue-in-cheek look at what might happen if amateur radio were to *really* enter the public spotlight, keeping in mind the old proverb: "He who makes waves must face the turning tide."

### National Security

As a result of the Watergate Affair, microphones under 13" in length will be strictly controlled by the government. The amateur would submit an application for a microphone permit, together with character references from his local constable, teacher and clergy. In addition, the ARRL would be asked to drop the word "bug" from its glossary of amateur terms.

### Civil Rights

It will be noted that amateur radio operators are represented by precious few minorities. The appropriate government agency will require that such minorities be actively recruited into the ranks of the amateur. The ARRL will be pressured to move its headquarters from Newington to Manhattan.

The agency will further require that at least 50% of amateur's on-the-air contacts be carried on with members of a minority group. The FCC will point out that it is quite difficult to determine ethnic background from call letters and will take the initiative to reassign such calls for easy recognition.

These new calls would be similar in a way to current citizens band designations – three letters and four numbers: For example – BLK-2468 or MEX-1357 or JEW-3691 or even NDN-8485. Periodically, the agency would check log books to determine an adequate percentage of ethnic calls are contained therein.

The Civil Liberties Union will of course object to the assigning of ethnic calls, and the Supreme Court will decide such calls are unconstitutional and will recommend that amateurs listen carefully for accents over the air in order to establish contact with minority members. The ARRL will perceptively observe this would be quite difficult using CW, and will offer 78rpm records entitled, "Sending and Receiving Morse Code with an Ethnic Accent of your Choice."

### Community Affairs Primetime Broadcasts

Amateur stations will now be included in the FCC's requirement that television sta-

tions devote portions of primetime to local community coverage. Thus, for a two hour primetime period each evening amateurs will be required to limit their contacts to other hams within their community. Citizens band operators will be politely asked to avoid working skip stations during this period.

**The Spectrum Crisis**

The shrinking availability of frequencies will cause difficulties for the amateur. Rationing will go into effect whereby each amateur receives coupons permitting so many hours of operating time each month. Coupons may be accumulated for long periods of operation such as DXpeditions.

A share-the-frequency program will be adopted similar to the splendid system now working on 40m phone wherein U.S. amateurs exist in perfect harmony with foreign broadcast stations.

Nets will be heartily encouraged to bring together the greatest number of amateurs on one frequency. Citations and fines for malicious interference will be dropped as this practice rarely takes place on a clear frequency.

Manufacturers of tin cans and twine will curiously note receipt of government grants for research and development.

**Unemployment**

Hard core unemployed persons will be recruited to work in electronic manufacturing assembly lines. Thus, kits will no longer be available for the amateur as all equipment must be factory-built to create these additional positions. On the bright side, however, the resulting product might be of such poor quality as to require the amateur to completely rebuild the item from scratch.

**Highway Safety**

Safety councils will begin to look into amateur mobile operation and its hazards, particularly the dangers of working a touch-tone pad while driving. Recognizing the value of autopatch, the councils will turn to the telephone companies for an adequate solution.

Already we have word of a new technology under way to eliminate the problem, and particularly to eliminate the complicated, wasteful technology now in existence.


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*We will swap you a year's FREE subscription to 73 HOTLINE for a year's subscription to your club's bulletin. How can you lose ? Just complete the form below and return. . .*

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Address _____

City _____ State _____ Zip _____

Instead of touchtone pads and the cumbersome associated electronics, telephone companies will hire multitudes of young ladies to personally handle calls. One would simply speak the desired number into the microphone and a pretty operator would patch the call through: Although the precise wording hasn't yet been decided upon, these ladies might ask, to determine your number, something like, "Number Plee-uze!"

**Pollution: Visual and Electromagnetic**

The visual aspects of towers, beams and mountain top repeaters will now be dealt with by the government's Environmental Protection Agency in its fight to rid our nation of visual pollution.

The policy of installing underground power and telephone cables will be extended to the amateur service. EPA will require antennas of all types to be installed beneath the ground. FCC will correctly note that such action may limit the effectiveness of communications and will recommend the establishment of a subcommittee to determine the feasibility of forming a commission to study suitable alternatives.

Recognizing that an underground antenna is far superior to none at all, EPA will move quickly to the problem of electromagnetic pollution.

First, electronic manufacturers will be required to install devices on all transmitting equipment to drastically reduce the power output. Amateurs will be warned not to remove these anti-pollution devices and will be required to submit their equipment for inspection on a regular basis.

The task of inspection will be given to local gas stations already established as state vehicle inspection agencies. Service station operators will welcome the responsibility as they will have precious little to keep busy with otherwise. A sticker will be placed on the transmitter with the expiration date noted thereon. Transmitters not passing the test will be given a rejection sticker requiring the owner to re-install the anti-pollution device within ten days or else forfeit the right to transmit.

The second step in the program to reduce the quantity of electromagnetic radiation will take the form of "contact pools."


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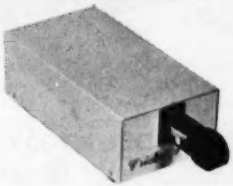

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Model PD 301 is a 300 MHz prescaler designed to extend the range of your counter ten times. This prescaler has a built-in preamp with a sensitivity of 50 mV at 150 MHz, 100 mV at 260 MHz, 175 mV at 300 MHz. The 95H90 scaler is rated at 320 MHz. To insure enough drive for all counters, a post amp. was built-in. The preamp has a self contained power supply regulated at 5.2V +.08%. (Input 50 Ohms, Output Hi Z)

All prescalers are shipped in a 4" by 4" by 1½" cabinet. All are wired and calibrated.

K-ENTERPRISES
1401 NORTH TUCKER
SHAWNEE, OK 74801
405-273-1598


Instead of each amateur operating his own station, groups of amateurs will be transported (by car pool, naturally) to the home of a particular ham. There, each will be given his turn at the equipment for a specified time. Each amateur will entertain the others in his home on a rotating basis.

The annual Field Day will also take on a new look. Rather than each club operating its own station, all clubs within a city will band together (no pun intended) and operate as one station, using, of course, but one station. *QST* will then list final scores by cities rather than by stations.

**Financial Security – A Happy Note**

First you've heard the bad news and now for the good news. I'm not too sure what this has to do with any of the above, but Japanese ham equipment has now been added to the list of great investments.

For example if you were to purchase a TR-22 now at age 20, by the time you retire at age 65 you could sell the unit and live quite comfortably. . . . K4ADL


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**GREENBELT, MD – FEB 3**

FM Minifest at the Goddard Space Flight Center. Speaker, movie, prizes, free refreshments. Time: 1PM.

**OAK PARK, MICH JAN. 12**

Oak Park Amateur Radio Club's sixth annual swap and shop at the Frost Junior High School Cafetorium, 23261 Scotia, Oak Park, Michigan.

**SOUTHFIELD MICH JAN 19**

Sponsored by the Southfield Amateur Radio Club, this is the largest Swap & Shop in Michigan. Southfield High School, Ten Mile and Lahser Rds., Southfield, Michigan. Tickets are $1.50 each. For info on tickets or tables write to Robert Younker, 24675 Lahser Rd., Southfield, Michigan 48075. Attn: Chas. A. Tyrrell.

**WEST ALLIS, WISC. – JAN 25**

The West Allis Midwinter Swapfest is Saturday, January 25, 1975 at Waukesha County Exposition Center located on Waukesha County Trunk Highway FT, Southwest of Waukesha County Airport. Doors open at 8 A.M. Refreshments, breakfast and lunch, available. Talk-in on 146.94. Rain or shine. Tickets $1 advance; $1.50 at the door. For details write WA9KRF, 4582 South Ahmedi Avenue, Milwaukee, Wisconsin 53207.

**MANSFIELD, OH FEB 7**

The Intercity Radio Club annual auction will be held Friday, February 7th at the Naval Reserve Training Center at Ashland Road in Mansfield, Ohio. Doors open at 6:00 P.M. Look, swap, buy at 7:30 P.M. No flea fees nor commissions charged. Auction at 8:00 P.M. Eats. Donation of two dollars at the door. For more information write K8JPF, 120 Homewood, Mansfield, Ohio 44906.

**WHEATON, ILL – FEB 9**

The Wheaton Community Radio Amateurs announce their 13th annual mid-winter hamfest on Sunday, February 9th at the DuPage County Fairgrounds, Wheaton, Illinois. Hours are 8 A.M. to 5 P.M. Tickets are $1.50 advance; $2.00 at the door. Free coffee and donuts 9:00 to 9:00 A.M. For information and advance tickets send a stamped self addressed envelope to L.O. Shaw, W9OKI, 433 S. Villa Ave., Villa Park, Ill. 60181.

*W2NSD from Page 2*

power increases – stiff opposition to Hiran try for grab of 450 hamband by Big Oil – Mexico says no Canadians can get a ticket – CARF election results – latest FCC repeater and Gettysburg report – new rule interpretation re control of repeaters – CBers get shaft in Detroit, in Jacksonville, in Des Moines and bad PR a lot of places.

Industry news includes the new Midland repeater program – the results of the Genave move to direct sales – the exciting growth of 160m – the reaction to the QST November editorial by industry – restraint of trade complaint lodged against QST – Crawford Amateur Radio Society vs CQ Magazine.

Add to that some late club events – auctions – QSO parties – plus a Godbout ad for some of the newest and most fantastic computer ICs... the first place ever advertised! It is possible to build an $8000-type computer with these new and incredible chips.

Hotline is available – mailed every other Friday by first class mail (some subscribers have been getting it by Saturday!) – the price is only $8 per year. Compare this to the similar, but much smaller report, done by typewriter, with about one half to one third the news, and costing $12 per year.

Readers with hot news of interest to really active hams are encouraged to send it to Hotline, 73 Magazine, Peterborough NH 03458. News of emergency operations, disasters, special club events, QSO parties, contests, certificates, newspaper clippings about amateur radio or CB, industry news, new products, FCC petitions, DX news, things like that...please send to Hotline.

.. WAYNE

# Voxpoop

## W2AOO WINS $50

**The winner of the VOX POOP award for November is W2AOO with his Digital Wind Indicator. Runners up were K2OAW's Counter Update and WAØABI's Basic Bridge. W2AOO receives $50 as a prize. Send in your vote for your favorite article this month and encourage the author to write again.**

**APPRECIATION...**

Not a few of the 73 readers accept 73 for what it really is – a hobby magazine for a bunch of fellows with relatively similar interests, without a lot of pretentions. They realize that the pages of 73 are wide open to anyone with ideas or something to say and that it doesn't have to filter through a board of directors, general manager, and a whole hierarchy before it can get into print. In fact, no one on the 73 staff has to even agree with the idea for it to get into print.

The articles are written entirely by the readers, not by engineers in a $100,000 HQ lab, which means that most of our projects work, even for the fellow with a test lab consisting of little more than a volt-ohm-meter.

One result of this approach to publishing the magazine is that a great many of the readers have feelings about 73...some love it, some hate it, but few are uncommitted. Much of the negative reaction comes from people who have a need for an authority to look up to so they won't have the responsibility of actually doing anything themselves. They get furious when 73 points out that there are some very good reasons for getting after the FCC...they prefer to let the ARRL do this and not to be bothered...after all, it's just a hobby. It is even worse when it turns out that the 73 readers were the ones which brought about some major changes for the better.

The 73 readers who enjoy the magazine and appreciate the openness of the pages to them act a lot more like good friends than paying customers for a product in that they write personal and friendly letters... even if they happen to disagree about an editorial or an article. They keep an eye on the papers and other magazines and send in clippings that they think will be of interest...clippings about amateur radio . . . about UFOs . . . CB . . . gravity experiments...all sorts of oddball things that they know will interest me...and a lot of other readers. These clippings are really appreciated for it gives me the feeling that I have eyes almost everywhere.

It is trite to say that this is your magazine. . .but this is true for it is written by you, the reader, with some seasoning thrown in from my imagination. . .and a good deal of that is, again, just reader feedback.

Let's suppose that you have a typewriter just sort of sitting around getting dusty and you get the feeling that it would be fun to see your name up in lights. . .well, in print. You sit down at the typewriter, put in the paper, and then you stare at it. And stare. The mind goes blank. You get up in disgust, rip out the paper, and go back to the hamshack a defeated writer.

Ridiculous. There are an infinite number of things to write about. You may be an FM'er who gets around on the repeaters a lot, so how about a short article on which repeaters are the most friendly for visitors, which are abrupt with transcients, which channels are the best for an amateur who may be going through your area.

Or perhaps you know an amateur who really goes out of his way to help amateur radio. . .how about an article about him, with some pictures? Not only will you reward him for his interest and work, but your article will certainly encourage others to be inspired to get busy and do something.

Perhaps you are into contests. . .so how about an article suggesting improvements in contest rules or one encouraging others to join you in your fun in working the contests? Certificates? Very little is written about them and a lot of amateurs would be interested in getting into certificate collecting if more were written about that part of the hobby. The fact is that just about every amateur is an "expert" on something or has an interesting story to tell.

The Japanese ham magazines are filled with pictures and stories of club activity. . .and they are interesting. Our clubs get into lots of fascinating projects, but not one single person in the club takes the interest to write up the adventure and get it published!

I'll say it again — 73 is *your* magazine — it is written by you — so use it to help amateur radio progress. . .to interest others. . .to give everyone more fun. And keep those letters and clippings coming in.

## ARE SHARED REPEATER CHANNELS A POSSIBILITY?

As repeater coordinating committees find themselves running out of channels to allocate, they are faced with the problems of what to suggest to new repeater groups which are looking for frequencies. Do they tell them that everything is taken on two meters and the new repeater must go up on 220 MHz or 450 MHz?

A talk with some of the coordinators and a listening check in some of the major areas where this has developed into a problem has brought out some factors which should be considered. The fact is that many of the repeaters are being used very little and it is unfair to other groups wanting channels to tie up pairs of frequencies for such limited use.

A survey of repeater activity in several areas seems to indicate that the overall number of repeater users has not noticeably increased during the last year or so. It appears that larger groups have in many cases broken up into smaller groups and set up their own repeaters. It does not appear that the smaller groups have been growing much once they have been established.

Commercial repeater users have had to work out systems of sharing channels and it appears that something like this might be a possibility for amateur repeater groups as an answer to the squeeze for spectrum space.

Take New York for instance — there are repeaters allocated to every known channel and splinter channel there — yet listening checks have shown that there are seldom more than six or eight repeaters in use, even during the heaviest usage hours of the day. If some system for channel sharing could be worked out it would permit more repeaters to be set up without any substantial sacrifice on the part of the present users in the area.

Time sharing of repeater channels will call for a basic change of attitude on the part of some groups. Where in the past the tendency has been to get involved in repeater wars and harrassment, groups will have to think in terms of cooperation and consideration. Can this change be made? Considering the volatile and infantile nature of some of the instigators of past repeater wars, one wonders if anything really is possible.

73 Magazine will welcome ideas along this line — and any information about cooperating repeaters which have worked out a channel sharing system.

## UGLY RUMORS UNTRUE

Rumor #1: the ham business is going down hill. Bunk! Some ham gear isn't moving well, of course. . . but most is in such short supply that dealers are crying for deliveries and manufacturers are fighting the battle of parts and labor, not sales. Sure, a bunch of dealers went out of the business when "incentive licensing" almost stopped sales of ham gear for a few years. . .but since those dark days there have been more and more ham dealers opening up and doing very well. Yes, National went bankrupt, but. . .that was from taking a bath on military contracts, not ham gear. . . and they are getting back into business again. . .watch for them.

Rumor #2: Hallicrafters is out of the ham business. Bunk! They changed owners again and they have some new designs in the works so watch for a new and expanded Hallicrafters line.

Rumor #3: Swan is going out of the ham business. Bunk! Jerry Ringer of Cubic, the parent company for Swan and Siliconix (CB arm of Swan), says not just no, but hell no.

Rumor #4: SBE is giving up the ham business. Bunk, says president Dave Thompson and Adman Bud Bane, new gear is in engineering for 1975.

Rumor #5: FM gear isn't selling like it used to. Bunk, again! It is a fact that the 22-up channel rigs are the big sellers now that almost every area of the country is blooming with new repeaters. It looks like the prediction of 2000 U.S. repeaters by the end of the year will be true. Icom probably could sell several times as many rigs if they could get them into the U.S. fast enough. Clegg is going in high gear. The new Multi-2000 and KDK-144 rigs, just announced, are already back ordered. HT's are selling unbelievably. . .it appears that virtually every FMer wants to have an HT on his belt or in his hand at hamfests and available for emergencies.

Rumor #6: Crystals aren't selling much now that there are so many synthesized two meter rigs. The shortage of these synthesized rigs and the lower initial cost of the crystal rigs has kept sales of the 22-up channel transceivers high. . .IC-22 — IC-21 — TR-72 — etc. The rigs end up costing about the same as the synthesized jobs, but the cost is spread out since crystals are bought a few at a time. Crystal manufacturers report that sales are as heavy this year as last and the problem is still in trying to keep up with the orders.

Rumor #7: Hams are not buying gear because they are worried about inflation. Utter rot. The fact is the reverse. . .most amateurs realize that now is the best time to buy gear since prices can do nothing but go up. The worst possible thing to hold on to is cash, the *only* thing that isn't going to inflate. The tighter you hold money, the more it shrinks.

Rumor#8: The antenna companies are in trouble. Bunk — in part. One of the bigger companies has been having

financial difficulties, but the rest seem to be doing okay. The only major gripe is not sales, but getting aluminum. . .and that is getting more and more difficult. KLM reports antenna sales booming along. Wilson's antennas are too.

The only soft spots in sales seem to be with those rigs which are well behind the state of the art. VHF amplifiers are selling very well. Surplus test equipment is doing fantastically. . .Tucker Electronics reports that better quality test gear is leading in sales. . .their Teco division reports ham gear doing very well. . .Yaesu leading. Atlas, in new headquarters, is working to cut down the back log of orders. Dentron reports 160m sales are extraordinary. . .that interest in 160 is growing more rapidly than they can handle. Interest in the new Heath rig. . .the SB-104 featured in the full color ads in the November issues of ham rags. . .is out of sight.

Watch for some equipment for the 160 kHz band, by the way. One of the major low band manufacturers is preparing gear for this band where no license is needed. . .160-190 kHz. . .one watt. . .50 foot antennas. DX up to 100 miles seems possible on this one and it may turn into a major experimenters delight.

One night while driving back to New Hampshire from New York, where I'd been for a business meeting, I was making my way through a blizzard, stopping every few miles to scrape the ice off my windshield so the wipers could get a grip. It was terrible conditions and I blessed my two meter rig for the security it gave my mind.

I'd started without dinner and as the night grew later I worried that I would run out of places to buy a snack. Somewhere along in Connecticut I suddenly came across an exit on the Thruway. Visibility was a minimum so I didn't know just where I was. Not far from the exit was a big shopping center with a discount house/supermarket. I went in and found a fantastic bakery department with incredibly delicious cookies and pastries.

Back on the thruway I was quickly involved in fighting the storm, workmy way through a couple of jacknifed trucks at New Haven, and talking with the wonderful group on the 01-61 repeater there. The more I ate of those cookies the more I wanted to stop back on the next trip and load up – they were the best pastries I'd ever eaten! I wanted to bring back a big bag of them and freeze them so my family could enjoy them for a long time. I almost always bring back a big bag of Bialy's from New York and freeze them for extended use – if you haven't tried Bialy's, then you've missed something very special.

On the next trip to New York I tried to find the shopping center and that bakery. It seemed to have disappeared. I tried every exit below New Haven and couldn't find anything. One of these days – perhaps the next time I'm driving through a blizzard – I'll come across that phantom supermarket.

## WHY AMATEURS DON'T BUILD

Through letters, contacts on the air, and talking at club meetings I hear the ever present chorus from old timers that hams are not building anymore – certainly not like they used to. And what a shame, for building used to be one of the most exciting and important aspects of the hobby. The newcomers just can't appreciate amateur radio the way old timers did when they buy all their equipment instead of building it.

Time after time I've tried to point out to old timers that nothing could be further from the truth. . .that newcomers are building a lot more than the old timers ever did. . .just look at the enormous number of pages of ads for parts in 73 Magazine and compare that with parts ads in the glorious building days of the 1930's. . .there is no comparison.

As my grandmother used to say, "A man convinced against his will is of the same opinion still."

Virginia was reporting on a talk she had had with an old timer. . .he asked if we couldn't just put in an occasional tube article for him and other old timers. . .that he didn't understand solid state stuff. . .and suddenly there it was! Flash! For the first time I realized what was causing all this difficulty. I realized why old timers are so completely convinced that hams are not building these days.

My first reaction was to marvel at my own denseness. . .to wonder why I hadn't realized this a long time ago and done something about it. The whole thing was so obvious once I thought about it.

For years I have known that the readers of ham magazines like construction projects more than anything else. I also realized that they enjoyed reading these articles more as fiction than for the actual building. A hundred thousand amateurs would read a particularly good article and fantasize building the unit described. . .while perhaps a couple hundred or so would actually build the project. . .and fifty more would use it with substantial modifications and improvements as part of something else.

Old timers spent years building tube circuits in their imagination and enjoying it. Then came transistors and the circuits all changed completely and no longer made sense. Oscillators no longer looked like oscillators. Mixers looked like Chinese writing. They couldn't build anymore. For a while they made do by reading QST, which kept plugging away with tube circuits through several years of transistor development. Eventually younger voices finally were able to make themselves heard, even in Newington, and QST reluctantly went solid state. It took a lot of pressure to get the old men at HQ to change, but they made it. This left old timers with no magazines publishing construction projects they could understand. . .and they translated this great and sad loss into a general feeling that no one was building anymore.

The old timers took heart rather late in the 60's when George Grammar wrote in QST that the reason QST published so few solid state articles was that amateurs were tube oriented and that he personally didn't believe that transistors were going to last, considering all of their serious drawbacks. Tubes would always be with us.

George was right in one way. . .transistors didn't last very long. After only a few years they got packed into little chips and appeared as ICs, further upsetting old timers who now found themselves two steps behind instead of just one.

Recognizing the problem is important for its solution, so I'm glad that this flash of inspiration came along as it will help us to pull things together. Being an old timer myself I can empathize. I feel a lot more comfortable with tubes and love to get together with other fogies and reminisce over 30's, 19's, 76's with slotted bases, and things like that. And remember the 15E. . .what a fantastic little tube that was!

One obvious move to help the situation will be for 73 to start publishing a few tube circuits. These will be good for old timers and give them comfort. They will also be good for a lot of newcomers who need inexpensive projects. . .and there are a whole lot of junk boxes bristling with old tubes. Another approach will be to try and publish some basic articles on modern solid state technology to help us old timers get oriented so we can at least read modern construction projects and follow them.

The next time you hear someone complaining about hams not building like they used to, see if the shoe doesn't fit.

. . . **Wayne**

**Submitted by:**
**Michael Kressila**
**Box 57**
**Marion OH 43302**

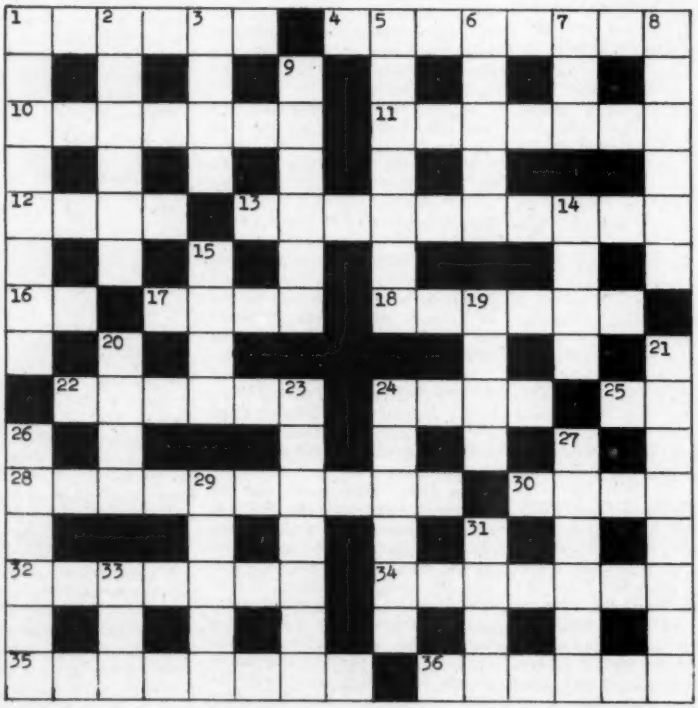
# PUZZLE

**ACROSS**

1. Unit of electric current flow.
4. A sinusoidal wave having a frequency that is an integral multiple of the fundamental frequency.
10. A clip used to make easy connection, located at the top of some radio tubes. (2 words)
11. Elevated conductor for sending or receiving radio waves.
12. The measure of the duration of an event.
13. A two-layer device that, above a certain reverse voltage has a sudden rise in current. (2 words)
16. Outside diameter. Abbr.
17. A sound wave capable of exciting an auditory sensation having pitch.
18. In a circle, the angle included within an arc equal to the radius of the circle.
22. Interference to radio reception due to electrical discharges.
24. Having a level surface.
25. Power line. Abbr.
28. An instrument for indicating the condition of vacuum tubes. (2 words)
30. Also called a diaphragm.
32. A continuous-wave, low-frequency navigation system that provides information over long distances.
34. One of the end sections of a transistor.
35. A term sometimes applied to the mid-range speaker in a three-way speaker system.
36. A unit of force, in the mksa system.

**DOWN**

1. A unit of measurement of a wavelength of light and other radiation.
2. Solids whose bases or ends are similar polygons and whose sides are parallelograms.
3. A metal panel upon which is mounted radio equipment.
4. Also known as "hams."
6. Reduced in volume, deadening a sound.
7. Girls nickname.
8. The cavity formed in the positive carbon electrode of an electric arc.
9. The place or range of action.
14. Elliptical.
15. Unit of electromotive force or pressure.
19. A means for indicating the value to which a control knob has been set.
20. Any short projection.
21. A tube in which the speed rather than the number of electrons is controlled by the input signal.
23. A two-stage triode amplifier.
24. A wire or set of wires supplying energy from a source to a load.
26. Remains upright.
27. A type of oscillator using electron coupling to the output circuit, popular with amateur radio operators.
29. To move the lever of a switch.
31. That quality of a thing which determines how much space it occupies.
33. Voice-frequency unit. Abbr.



*SOLUTION ON PAGE 122*

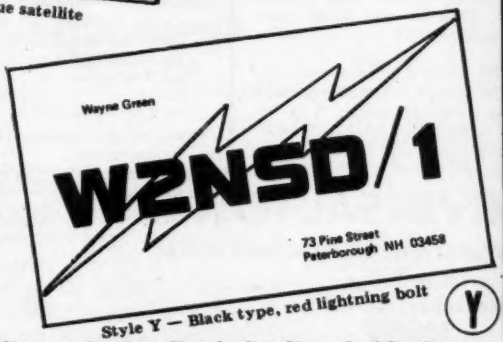
# BRAND NEW QSLs

- two styles
- QSO info back
- two colors
- LOW PRICES

X

Style X — Black type, blue satellite

*While the cost of everything continues to skyrocket, 73 has STILL kept the price of these beautiful QSLs at absolute rock bottom. When we started selling our top quality QSLs two years ago at a PENNY-A-PIECE it was a great deal (postpaid no less!). When we held that price firm last year against all obstacles, it became a fantastic opportunity. Now, this year we're STILL HOLDING DOWN THE PRICES and it's the next best thing to having your very own oil well! And with two brand new designs too!*




Y

Style Y — Black type, red lightning bolt

| ORDER — AND PAY |
|---|
| 250 . . . . . $6 (2.5¢ ea) |
| 500 . . . . . $10 (2¢ ea) |
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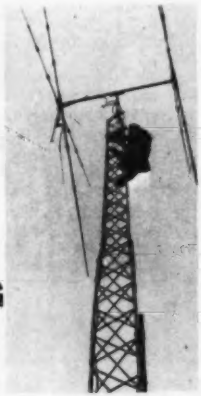

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**SOLUTION TO PUZZLE, p. 120**

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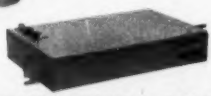

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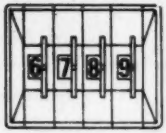


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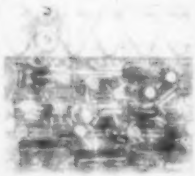

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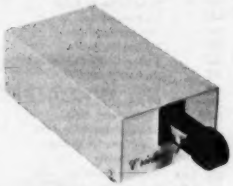

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**Linear Price Schedule**

| | | | |
|---|---|---|---|
| 300 | Pos. V Reg. (Super 723) | TO5 | .80 |
| 301 | Hi performance Ampl. | TO5 or mini | .30 |
| 302 | Voltage follower | TO5 | .80 |
| 304 | Negative Regulator | TO5 | 1.00 |
| 305 | Voltage Regulator | TO5 | 1.00 |
| 306 | Voltage Comparator/Buffer | TO5 | 4.00 |
| 307 | Op Amp (Super 741) | TO5 or mini | .30 |
| 308 | Micro power op Amp. | TO5 | 1.00 |
| 309H | 5V Regulator (200 MA) | TO-5 | 1.75 |
| 309K | 5V Regulator (1A) | TO-3 | 1.50 |
| 310 | Voltage follower Op. Amp. | TO5 or mini | 1.00 |
| 311 | Hi performance Voltage Comparator | TO5 or mini | 1.00 |
| 320 - 5.0V | Negative Regulator | T03 | 1.75 |
| - 5.2V | Negative Regulator | T03 | 1.75 |
| - 12V | Negative Regulator | T03 | 2.00 |
| - 15V | Negative Regulator | T03 | 1.75 |
| 322 | Precision Timer | DIP | 2.25 |
| 324 | Quad Op. Amp. | DIP | 1.75 |
| 339 | Quad Comparator | DIP | 2.00 |
| 340K | Pos V Reg (+5,6,8,12,15,18,24 V) | TO-3 | 1.75 |
| 340T | Pos V Reg (+5,6,8,12,15,18,24 V) | TO-22 | 2.00 |
| 350 | Dual Peripheral Driver | Dip | .80 |
| 351 | Dual Peripheral Driver | Mini | .40 |
| 370 | AGC/Squelch Amp. | DIP | 1.00 |
| 371 | Integrated RF/IF Amp. | TO5 | 1.75 |
| 372 | AF - IF strip - detector | DIP | .75 |
| 373 | AM/FMI SSB strip | DIP | 3.00 |
| 374 | AM/FM/SSB IF Video Amplifier | Dip | 2.75 |
| 376 | Pos. Volt Regulator | Mini | .50 |
| 377 | Dual 2W Power Amp | Dip | 2.50 |
| 380 | 2 Watt Audio Amp. | DIP | 1.50 |
| 380-8 | .5WAudio Amp. | Mini | 1.25 |
| 381 | Low Noise Duel Pre Amp | DIP | 1.75 |
| 382 | Low Noise Stereo Pre Amp | DIP | 1.75 |
| 550 | Precision Voltage Regulator | DIP | 1.50 |
| 555 | Timer | Mini | 1.00 |
| 565 | Phase Lock Loop | TO5 or Dip | 2.50 |
| 566 | Function Generator | Mini | 2.50 |
| 567 | Tone Decoder | Mini | 2.50 |
| 703 | RF – IF Amp. | TO5 | .40 |
| 709 | Op Amp. | TO5 or Dip | .30 |
| 710 | Voltage Comparator | TO5 or Dip | .30 |
| 711 | Dual Diff. Comparator | TO5 or Dip | .30 |
| 723 | V Regulator | TO5 or Dip | .80 |
| 725 | Instrumentation Op Amp | Mini | 2.25 |
| 733 | Video Amp | Dip | 1.25 |
| 741 | Comp Op Amp. | TO5, Mini, or Dip | .40 |
| 747 | Dual 741 Op Amp. | TO5 or Dip | .80 |
| 748 | Freq. Adj. 741 | Mini | .40 |
| 1303 | Stereo Pre Amp. | Dip | .75 |
| 1304 | FM Multiplex Stereo Demod. | Dip | 1.00 |
| 1306 | FM Multiplex Stereo Demod. | Dip | 1.50 |
| 1307 | FM Multiplex Stereo Demod. | Dip | .75 |
| 1310 | Stereo Demodulator | Dip | 2.50 |
| 1351 | FM Detector/Limiter &Audio Preamp | Dip | 1.00 |
| 1414 | Dual Differential Comparator | Dip | .90 |
| 1436 | High Voltage Op Amp | TO-5 | 3.95 |
| 1458 | Dual Comp. Op Amp. | TO5 or Mini | .70 |
| 2111 | FM Detector & Limiter | Dip | .90 |
| 2113 | FM Detector & Limiter | Dip | .90 |
| 3064 | TV Automatic Fine Tuning Circuit | Dip | .75 |
| 3065 | TV - FM Sound System | Dip | .80 |
| 3070 | Chroma Subcarrier Regenerator | Dip | 1.35 |
| 3071 | Chroma IF Amplifier | Dip | 1.35 |
| 3072 | Chroma Demodulator | Dip | 1.35 |
| 3075 | FM Detector - LMTR and Audio Pre Amp. | DIP | .70 |
| 3900 | Quad Amp. | DIP | .70 |
| 3905 | Precision Timer | Mini | 1.40 |
| 4250 | Programmable Operational Amplifier | Dip | 2.25 |
| 6070 | Chroma Subcarrier Regenerator | Dip | .50 |
| 6072 | Chroma Demodulator | Dip | .20 |
| 75450 | Dual Peripheral Driver | Dip | .50 |
| 75451 | Dual Peripheral Driver | Mini | .40 |
| 75452 | Dual Peripheral Driver | Mini | .40 |
| 75453 | Dual Peripheral Driver | Mini | .60 |
| 75454 | Dual Peripheral Driver | Mini | .50 |
| 75491 | Quad seg driver for LED readout | DIP | 1.25 |
| 75492 | Hex digit driver | DIP | 1.25 |
| 75493 | Four Segment LED Driver | Dip | 1.40 |
| 75494 | Six Digit LED Driver | Dip | 1.50 |

**7400 series Price Schedule**

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00 | .20 | H05 | .30 | 13 | .75 | L30 | .30 | 48 | 1.50 | H82 | .50 | 75 | 1.00 | 92 | 1.00 | 123 | 1.00 | L157 | 1.25 |
| H00 | .30 | S05 | .50 | 14 | 2.00 | H30 | .30 | 50 | .20 | S 64 | .50 | 76 | .40 | 93 | 1.00 | 9602 | .60 | S157 | 1.50 |
| L00 | .30 | 06 | .40 | 16 | .40 | 37 | .35 | 51 | .20 | 70 | .30 | H76 | .60 | L93 | 1.25 | 125 | .70 | 158 | 2.00 |
| S00 | .50 | L06 | .50 | 17 | .40 | 38 | .35 | L51 | .30 | 71 | .35 | L78 | .80 | 94 | 1.00 | 128 | .70 | 160 | 1.50 |
| 01 | .20 | 07 | .40 | 20 | .20 | 39 | .50 | H51 | .30 | H71 | .50 | 83 | .80 | 95 | 1.00 | 132 | 3.00 | 161 | 1.50 |
| H01 | .30 | 08 | .20 | H20 | .30 | 40 | .20 | H52 | .40 | L71 | .50 | 85 | 1.00 | L95 | 1.25 | S 140 | 1.50 | L161 | 2.00 |
| 02 | .20 | H08 | .30 | L20 | .30 | H40 | .30 | 53 | .20 | 72 | .35 | L85 | 1.50 | 96 | 1.00 | 141 | 1.50 | 162 | 1.50 |
| L02 | .30 | 09 | .20 | S20 | .50 | S40 | .50 | H53 | .30 | H72 | .50 | 86 | 2.50 | L96 | 2.00 | 145 | 1.25 | 163 | 1.50 |
| 03 | .20 | 10 | .20 | H21 | .40 | 41A | 1.00 | 54 | .20 | L72 | .50 | L86 | .50 | 100 | 1.50 | 150 | 1.25 | 164 | 2.00 |
| L03 | .30 | H10 | .30 | H22 | .40 | 42 | .50 | H54 | .30 | 73 | .40 | S86 | .50 | 107 | .40 | 151 | 1.00 | L164 | 2.50 |
| S03 | .50 | L10 | .30 | S22 | .50 | L42 | 1.50 | L54 | .30 | H73 | .55 | 88 | .80 | 109 | .90 | 152 | 3.00 | 165 | 2.00 |
| 04 | .20 | S10 | .50 | 23 | .40 | 43 | 1.50 | L55 | .40 | L73 | .55 | 89 | 5.00 | S112 | 1.50 | 153 | 1.00 | L165 | 2.50 |
| H04 | .30 | 11 | .20 | 25 | .40 | 44 | 1.50 | H55 | .40 | 74 | .45 | 90 | 3.00 | S113 | 2.00 | S153 | 1.50 | 166 | 1.50 |
| L04 | .30 | H11 | .30 | 26 | .40 | 45 | .90 | 60 | .30 | H74 | .80 | L90 | 1.00 | S114 | 2.75 | 154 | 1.50 | 170 | 3.00 |
| S04 | .50 | S11 | .50 | 27 | .40 | 46 | 1.50 | H60 | .50 | L74 | .60 | 91 | 1.00 | 9601 | .40 | 155 | 1.00 | 173 | 2.00 |
| 05 | .20 | 12 | .50 | 30 | .20 | 47 | 1.50 | H61 | .50 | S74 | .80 | L91 | 1.25 | 122 | .75 | 157 | 1.00 | 174 | 2.00 |

**DTL SPECIALS**

| | | |
|---|---|---|
| 930 | Dual 4 Gate/Exp | .18 |
| 932 | Dual 4 Buffer | .18 |
| 933 | Dual 4 Extender | .18 |
| 935 | Hex Inverter/Exp | .18 |
| 936 | Hex Inverter | .18 |
| 937 | Hex Inverter Gate | .18 |
| 944 | Dual Buffer | .18 |
| 945 | RS Clocked FF | .25 |
| 946 | Quad 2 Gate | .18 |
| 948 | RS Clocked FF | .25 |
| 949 | Quad 2 Gate | .18 |
| 957 | Quad Buffer | .20 |
| 958 | Quad Power Gate | .20 |
| 961 | Dual 4 Gate/Exp | .18 |
| 962 | Triple 3 Gate | .18 |
| 963 | Triple 3 Gate | .18 |
| 9093 | Dual JK FF | .34 |
| 9094 | Dual JK FF | .34 |
| 9097 | Dual JK FF | .34 |
| 9099 | Dual JK FF | .34 |

**Brand New CMOS**

| | | | | | |
|---|---|---|---|---|---|
| 74C00 | .50 | 74C163 | 3.00 | CD4013 | 1.10 |
| 74C02 | .50 | 74C164 | 4.00 | CD4014 | 3.75 |
| 74C04 | .75 | 74C165 | 4.00 | CD4015 | 3.75 |
| 74C10 | .50 | 74C173 | 3.75 | CD4016 | 1.10 |
| 74C20 | .50 | 74C174 | 3.75 | CD4017 | 3.00 |
| 74C30 | .50 | 74C182 | 5.00 | CD4018 | 4.75 |
| 74C42 | 2.75 | 74C193 | 5.00 | CD4019 | 1.20 |
| 74C73 | 1.50 | 74C195 | 3.00 | CD4020 | 5.25 |
| 74C74 | 1.10 | 74C901 | 1.25 | CD4021 | 3.75 |
| 74C76 | 1.60 | 74C902 | 1.25 | CD4022 | 4.00 |
| 74C83A | 3.25 | 74C903 | 1.25 | CD4023 | .50 |
| 74C85 | 3.25 | 74C904 | 1.25 | CD4024 | 2.75 |
| 74C86 | 1.25 | 80C95 | 1.50 | CD4025 | .50 |
| 74C89 | 12.75 | 80C97 | 1.50 | CD4027 | 1.60 |
| 74C95 | 3.50 | CD4001 | .50 | CD4029 | 5.75 |
| 74C107 | 1.60 | Cd4002 | .50 | CD4030 | 1.10 |
| 74C151 | 3.00 | Cd4002 | 3.75 | CD4035 | 2.75 |
| 74C154 | 5.00 | CD4007 | .75 | CD4037 | 2.75 |
| 74C157 | 2.50 | CD4008 | 3.75 | CD4040 | 4.75 |
| 74C160 | 3.00 | CD4009 | .80 | CD4042 | 2.75 |
| 74C161 | 3.00 | Cd4010 | .80 | CD4044 | 2.75 |
| 74C162 | 3.00 | CD4011 | .50 | CD4049 | 1.10 |
| | | CD4012 | .50 | CD4050 | 1.10 |
| | | | | CD4116 | 1.30 |

**Memories**

| | | |
|---|---|---|
| MM 5260 | 1024 bit RAM (2nd generation 1103) | 5.00 |
| p1101 | 256 bit RAM | 2.00 |
| p1103A | 1024 bit RAM | 7.00 |
| 7489 | 64 bit RAM | 2.75 |
| 8223 | 256 bit bipolar Field PROM | 6.00 |
| 8225 | 64 bit RAM | 3.75 |
| 74200 | Tri-State 256 bit RAM | 9.25 |
| DM8599 | Tri-State 64 bit RAM | 3.75 |
| p2102 | 1024 bit static RAM | 15.00 |
| 2602 | 1024 bit Static RAM | 16.00 |

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|---|---|---|---|---|---|
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| 175 | 2.00 | 193 | 1.50 | | |
| S175 | 3.00 | L193 | 2.00 | | |
| 176 | 1.00 | 194 | 1.50 | | |
| 177 | 1.00 | 195 | 1.00 | | |
| 178 | 3.00 | L195 | 1.50 | | |
| 179 | 3.00 | 196 | 2.00 | | |
| 180 | 1.00 | 197 | 2.00 | | |
| 181 | 3.00 | 198 | 2.00 | | |
| 182 | 1.00 | 199 | 2.00 | | |
| 184 | 2.00 | 200 | 7.00 | | |
| 185 | 2.00 | S200 | 9.99 | | |
| 189 | 3.00 | 251 | 1.75 | | |
| 190 | 2.50 | 284 | 4.25 | | |
| 191 | 3.00 | 285 | 4.25 | | |
| 192 | 1.50 | 8266 | 2.60 | | |
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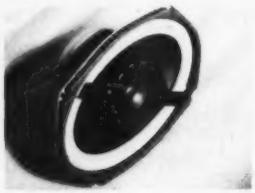

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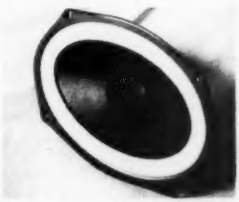

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| Model Number | Application | Nominal Cone Dia. | Suspension Material | Magnet Weight | Magnet Material | Voice Coil Dia. | Free Air Resonance | Response Range | Continuous Power rating (watts RMS) | Imped. (ohms) | Price Each |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5PC10 | Full range | 5" | Treated Cloth | 10 oz. | Ferrite | 1" | 70-80 Hz | 70-12k | 25 | 8 | $ 6.90 |
| 6FW10 | Woofer | 6" | Treated Cloth | 10 oz. | Ferrite | 1" | 50-65 Hz | 35-3500 Hz | 15 | 8 | $ 6.90 |
| 8W5 | Woofer | 8" | Treated Paper | 5 oz. | Ferrite | 1" | 50-65 Hz | 35-3500 Hz | 15 | 6 | $ 5.90 |
| 10W6.8 | Woofer | 10" | Rubber | 6.8 oz. | Alnico V | 1½" | 20-25 Hz | 25-2500 Hz | 35 | 6 | $14.90 |
| 10W20 | Woofer | 10" | Foam | 20 oz. | Ferrite | 1½" | 20-29 Hz | 20-2500 Hz | 50 | 6 | $22.90 |
| 69F10 | Full range | 6x9" | Foam | 10 oz. | Ferrite | 1" | 80-90 Hz | 45-12 kHz | 15 | 8 | $ 6.90 |
| 6x9C | Coax full range | 6x9/3" | Foam/ Paper | 20 oz/ 10 oz. | Ferrite/ Alnico V | 1"/9/16" | 60-70 Hz | 45-16 kHz | 20 | 8 | $15.00 |
| 5M1.5 | Mid-range | 5" | Impreg. Paper | 1.5 oz. | Alnico V | 9/16" | N/A | 600-1500 Hz | 5 | 6 | $ 5.50 |
| 3T1 | Cone Tweeter | 3" | Impreg. Paper | 1 oz. | Alnico V | 9/16" | N/A | 1400-1600 Hz | 5 | 6 | $ 2.98 |
| 3T.53 | Cone Tweeter | 2" | Roll Edge Paper | .53 oz. | Alnico V | | N/A | 1400-1600 Hz | 5 | 6 | $ 2.00 |
| FD3 | Flare Dome Tweeter | N/A | Note 3 | 2.35 oz. | Ferrite | 9/16" | N/A | 1800-20, 000 Hz | 5 | 8 | $ 5.25 |
| FD7 | Flare Dome Tweeter | N/A | Note 3 | 7.4 oz. | Ferrite | 3/4" | N/A | 1800-20, 000 Hz | 10 | 8 | $ 6.50 |

**AAS indicates the weight of the magnet itself. Magnetic structure adds a considerable amount to this figure.**

**Notes**

1. N/A – not applicable
2. 5M1.5 is a closed back mid-range
3. FD2 and FD3 have vynal surround to maximize dispersion of high frequencies

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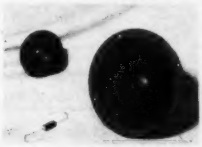
Specifications:

Frequency response: 35 to 16,000 Hz
Continuous power rating: 15 watts rms
System impedance: 8 ohms
Components: 6FW10, 3T53, and crossover capacitor.
Order Number: MP62
**SYSTEM PRICE: $8.90**



## Good Listening (our most popular system)

AAS offers this quality, high performance matched system, to the build it yourselfer. When installed in a sealed, acoustic suspension cabinet this combination will give precise transients, clear midrange and most important with today's rock music, solid resonance free bass.

Specifications:

Frequency response: 20 to 16,000 Hz
Continuous power rating: 35 watts rms
System impedance: 6-8 ohms
Components, woofer 10W6.8, midrange 5M1.5
Tweeter 3T1 and matched 3 way crossover.
Order Number: GL1053
**SYSTEM PRICE: $23.50**

## AAS High Power System

Handles 100 watt transients and a continuous 50 rms watts of driving bass you can feel — with ease, also includes a powerful midrange pair for clean clear voices and the remarkable flare dome tweeter for crisp highs to 20,000 Hz. This system also includes an RCL crossover that lets you adjust the midrange and tweeter levels to match room acoustics. So if you have a super receiver, enjoy high listening levels and have understanding neighbors, this is the system for you.

Specifications:

Frequency response: 20 to 20,000 Hz
Continuous power rating: 50 watts rms
System impedance: 6-8 ohms
Components, woofer 10W20, midrange two 5PC10's
Tweeter FD7 and RCL crossover network.
Order Number: HPS
**SYSTEM PRICE: $47.50**

Construction note: A sealed acoustic chamber is necessary to isolate the open back middlers and prevent interference with the woofer.

## VERADA 214 STOCKS THE COMPLETE LINE OF AAS COMPONENTS

### SPEAKER ENCLOSURE KITS

In this time of rising prices, more and more people are becoming do-it-yourselfers. And for you experts in the field of home brew, this offer is ideal. We have a variety of speaker enclosure kits covering the full range of your high fidelity requirements. Want a $300 system for less than half that price? We have it. Want an inexpensive bookshelf system at a price you'll barely notice? We've got that too. And everything in between!!!! Or you can buy these systems fully assembled and still save $$$$.

*Write for our special speaker enclosure catalog.*

### SPEAKER GRILLE CLOTH

Verada 214 offers grille cloth at $6.00/yard, and OUR YARDS ARE 36 x 60" or wider. Remember, drapery or upholstery material is NOT acoustically transparent enough to be used as grille cloth.

Choose from:

Black #GCBK  Silver #GCSR
Dk Brown #GCDB  Lt. Brown #GCLB

or send $1.00 (refundable) and receive samples and other information.

### WARRANTY

**Loud speakers are guaranteed for two years against defects in material and workmanship in accordance with the Standard Electronic Industry Association Warranty.**

**Triple Binding Post**

1925 vintage, oldie but goodie. Use as replacement on old test gear or for building new. Accepts wires or spade lugs. Bakelite and brass.
#TBP **50¢ ea., 3/$1.00**

**Tube Sockets**
**40 Assorted**
Includes octals, loctals, 7&9 pin and others.
#40TS **40 tube sockets** **$1.00**

**Micro Switches**
Assortment of 5 different handy micro switches. Use them as tamper switches in alarm systems.
#MSS **5 for $1.00**

**Sprague Energy Storage Caps**
25uF @ 4KV Porcelain Terminals 3½" x 5" x 10". Great for photo flash. Laser projects. The exploding wire game, etc. Brand new in boxes.
#esc **$10.00 each**

Very popular high speed dc hobby motor. Runs easily on a single dry cell, or use higher voltage for higher speed. Reversible ¼" x 3/32" shaft.
#198 **65¢ ea., 2/$1.00**

Externally threaded steel tubing – 12½"L x 3/8" dia. Standard size for construction of table lamps.
#4206 **40¢ea., 3/$1.00**

**Super Miniature I.F. XFMR Assortment**

Marked with MFRS part number only, brand new, probably some 455KC some 10.7 MHz FM.
#IFX **10 different $1.00**

**9 Volt Battery Connector**

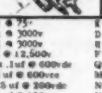
When was the last time you built something and wound up soldering to the battery terminals? Insulated connector with red & black leads, stock up now.
#J182 **18¢ ea., 7/$1.00**

**Crimp Terminals**
We purchased millions so that we can offer 65 to 80% off list price.
#J171 **100 asst'd insulated $1.65**
#J174 **100 asst'd uninsulated $1.25**

**IRC Power Resistor**
50 watts 40 ohms 4½ x ¾ inches, prefect for high power supplies. Removed from equipment.
50¢ ea., 3/$1.00

**Magnifying Lens**
3" diam. 1¾" thick for wide angle optical applications. Makes great floodlight lens, or a novel paper weight. Sh. Wt. 1 lb.
#DHL **95¢**

**Trimpots**



10K ohm, vertical printed circuit board mount. Made by C.T.S., screwdriver adjustable.
#J182 **24¢ ea., 5/$1.00**

**T1107**

Silicon plastic TO-92 super popular medium power transistor, new and tested.
#T1107 **25¢ea., 5/$1.00**

10 germanium diodes in series causing a drop of 6.1 volts, creating a very stable voltage reference.
#J143 **2/$1.00**

**NPN Matched Transistor Quad. In DIP Package**
Motorola put 4 matched transistors in one of the handiest packages we've seen. Comes with specs.
#M42501-1 **$.58 ea.**

**Experimenter's Special**
10 different specially made D.I.P. ICs. All TTl compatible. Data sheet included for each type. See what your imagination can do with these.
#EXP 8 **8/$1.00**
#EXSP100 **100 Asst'd/$10.00**

Are you into antique electronics? 1958 magazine projects got you bogged down for parts? Just for you: 2N113 – 22¢, CK761 – 22¢, 2N396 – 24¢, 2N385 – 16¢, 2N155 – 85¢, 849RTL IC – 15¢, 1N34 – 3¢.

**Floor Sweeping Special**
Many diodes, transistors and ICs (and maybe a little sawdust). Over 100 pieces $1.00
#FSS

Red LED – gold plated leads, new, tested – 5/$1.00

Hewlett Packeard red LED with plug-in leads – 5/$1.00

**Sylvania Diode Array**

4 diodes in a package with common cathode connection and separate anodes.
#M9336 **20¢ ea., 8/$1.00**

Leds red, 18¢ each, 6/$1.00, 100/$15.00.

**10 Diff. Diode Arrays**
**bridges**
**references**
**matrixes**
#J142 **10/$1.00**

**Micro-Transistor**

Less than 0.085" square with 7/8" long gold leads. For use in micromodules, hybrid circuits, or in and light weight and small size application such as in balloon and rocket transmitters or for secret bugging devices. New and guaranteed. Specs similar to 2N2501 NPN silicon.
#MT **2/$1.00**

**General Purpose Diodes**

These are probably the most popular diodes ever made. Thousands of uses, light duty supplies, decoding, switching, meter rectifiers – build your kid a crystal set. All tested and guaranteed.
#J133G **30 germanium/$1.00**
#J133S **30 silicon/$1.00**

**Texas Dual Transistor**

Two matched silicon PNP transistors in a six lead TO-5 case, new and guaranteed.
#T.I3347-1 **$1.00 ea.**

**Special Purchase**
**POWER TUNEABLE VARACTOR**
New gold plated & similar to MA 4060, use in doublers and triplers. Fully guaranteed, or return for full refund. Instructions included.
**PTV each** **$4.00**
**5PTV** **5/$15.00**

**ITT NPN Silicon**

Great for TTL switching BV-CES 30V, BV-EBO 5V, and h-fe 30. Data sheet upon request only.
#2N2501 **4/$1.00**

**Jumbo Red Led**

Long body for chassis feed through – new, tested.
**5/$1.00**

**NPN Silicon**

Photo Transistors
These high quality, gold plated photo transistors can be used in alarm systems, tape and card readers, level controls and to remote control equipment by flashlight new and guaranteed.
#NPN Photo only **2/$1.00**

**50 Asst'd Transistors**
No test. Super mixture of NPNs – PNPs – silicon – germanium power – switching – audio and more.
#J124 **$1.00**

**Molex Socket Pins**

Molex pins, on a strip, make any size IC socket. Just cut off the number of connections you need, solder in place, and break off interconnecting retainer strip.
#MOLEX **100/$1.00**

Fuses at an old fashioned 10¢ each – choose from:
1/8A, slo-blo, Fig. a., clear; MDL 2/10 A., Fig. d., slo-blo; MDL 2A, Fig. d., slo-blo; AGC 1A, Fig. d., Standard; ABC 3A, Fig. e., ceramic tube; ABC 5A, Fig. e., ceramic tube; SFE 6A, Fig. h., 7/8" long; SFE 7½A, Fig. h., 7/8" long; SFE 9A, Fig. h., 7/8" long; SFE 30A, Fig. h., 7/8" long.

**High Power Audio Transistors**

2N3055, NPN, 115 watts, .75; 2N3713, NPN, 150 watts, 1.65; 2N3789, PNP, 150 watts, 1.65; 2N6030, PNP, 200 watts, 2.80. Data sheets for above only upon request. Tested and guaranteed.

**Hobby DIP ICs**

A collection of 20 ICs that are unmarked or have special #s we don't understand. All new chips – maybe you can decode them.
#J100 **20/$1.00**

| CAPACITORS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| VALUE | TYPE | PRICE | | | | | | | |
| 68pf | K | .07 | .1 @ 75v | K | .07 | 500uf @ 50v | I | .38 | |
| 150pf | mica | .07 | .1 @ 3000v | D | .75 | 800uf @ 99v | C | 2.85 | |
| 220pf | K | .07 | .1 @ 3000v | N | .75 | 1250uf @ 150v | C | 3.20 | |
| 270pf | K | .07 | .1 @ 12,500v | F | $2.10 | 3750uf @ 3vdc n.p. | B | 1.50 | |
| .0002Suf @ 600vdc | P | .22 | 3x .1uf @ 600vdc | Q | .38 | 10,000uf @ 11vdc | B | 3/dia. | 3.50 |
| .0003Suf @ 600vdc | P | .22 | .3 uf @ 600vcc | M | .45 | 55,000uf @ 25vdc | B | 3/dia | 4.50 |
| .0005uf @ 1000vdc | P | .22 | .35 uf @ 200vdc | N | .75 | 160,000uf @ 10vdc | B | 3/dia | 5.50 |
| .001uf @ 1000vdc | P | .22 | .5 uf @ 150vac | N | .75 | .062 @ 100v | G | | .12 |
| .0022uf @ 1200vdc | P | .22 | .5 uf @ 600v | M | .65 | 500uf @ 10v alum | J1/4dia. | | .45 |
| .0022 @ 2500vdc | P | .35 | .5uf @ 600v | D | .65 | | | | |
| .003uf @ 600vdc | P | .22 | .5uf @ 2000v | short D | .95 | | | | |
| .003uf @ 1000vdc | P | .22 | .5uf @ 2500v | D | $1.15 | | | | |
| .003uf @ 1200vdc | P | .22 | 2x .5uf @ 400vdc | M | .95 | | | | |
| .003uf @ 1400vdc | P | .22 | .68uf @ 600vdc | I | .75 | | | | |
| .004uf @ 1000vdc | P | .22 | 1uf @ 200vdc | G | .35 | | | | |
| .005uf @ 1000vdc | P | .22 | 1uf @ 200vdc | P | 1.25 | ADDITIONAL CAPACITORS | | | |
| .0056uf @ 1000vdc | P | .22 | 2uf @ 6v | mini J | .35 | .000022uf @ 2500vdc | P | .28 | |
| .006uf @ 1000vdc | P | .22 | 2uf @ 1000v | D | 1.40 | .0022uf @ 2500vdc | P | .28 | |
| .01uf @ 100v | P | .22 | 4uf @ 1000v | D | 1.85 | .02uf @ 500v | K | .10 | |
| .01uf @ 200vdc | P | .22 | 8uf @ 330vac | A | 2.35 | .033uf @ 600vdc | P | .27 | |
| .01uf @ 400vdc | P | .22 | 10uf @ 10v mini tantalex | | .25 | .039uf @ 600vdc | P | .29 | |
| .01uf @ 600vdc | P | .22 | 2x 10uf @ 450vdc | B | 1.00 | .05uf @ 1000vdc | K | .15 | |
| .01uf @ 1000vdc | P | .22 | 15uf @ 450vdc | D | 1.50 | .25uf @ 600vdc | O | .22 | |
| .015uf @ 1000vdc | P | .22 | 22uf replar | mini L | .35 | .25uf @ 1000vdc | P | .22 | |
| .02uf @ 100v | P | .22 | 30uf @ 330vac | larger D | 2.50 | .25uf @ 1000vdc | short D | 1.45 | |
| .02uf @ 600vdc | P | .22 | 33uf @ 330vac | larger D | 2.50 | .5uf @ 100vdc | M | .85 | |
| .02uf @ 1000vdc | P | .22 | 33uf @ 300vdc | H | .95 | .5uf @ 200vdc | M | .95 | |
| .022uf @ 100v | P | .22 | 40uf @ 66/vac | larger D | 5.95 | .5uf @ 400vdc | M | .95 | |
| .022uf @ 1200vdc | P | .22 | 40uf @ 66/vac | larger D | 5.95 | 1uf @ 200vdc | D | 1.50 | |
| .022uf @ 2500vdc | P | .35 | 40uf @ 66/vac | larger D | 5.95 | 2uf @ 500vdc | O | .36 | |
| .03uf @ 600vdc | P | .22 | 1uf @ 200vdc | G | .35 | 4uf @ 66/vac | C | 1.15 | |
| .033uf @ 600vdc | P | .27 | 1uf @ 200vdc | P | 1.25 | 8uf+12uf @ 450vdc | N | .65 | |
| .039uf @ 600vdc | P | .29 | 2uf @ 6v | mini J | .35 | 3x 15uf @ 250vdc | A | 1.10 | |
| .05uf @ 1000vdc | P | .22 | 2uf @ 1000v | D | 1.40 | 2x 40uf @ 450vdc | N | 1.00 | |
| .05uf @ 1200vdc | P | .22 | 4uf @ 1000v | D | 1.85 | 1000uf @ 25vwdc | I short | .25 | |
| .05uf @ 250v | F | .21 | 8uf @ 330vac | A | 2.35 | | | | |
| .05uf @ 600vdc | P | .22 | 10uf @ 10v alum | J | .35 | | | | |
| .05uf @ 1000vdc | P | .22 | 50uf @ 15v | I | .37 | | | | |

## DAVEN RF ATTENUATORS AND DELAY LINES

The construction and precision of these units is exceptional. The case is solid brass, silver plated with stainless steel shaft and hardware. B&D are rf attenuators using Daven high precision, matched resistor networks and rotary switches with gold contacts. A&C are delay lines constructed of silver plated hard line coax. All units are completely shielded (we removed sides for photo) and have gold input and output connectors. We are including 2 lengths of silver and teflon coax with mating connectors for each unit.

A. Delay line – impedance 75Ω, 16 .1NS steps for a range of 0-1.5NS, 1 W. Max. input.
#DAVEN A **$10.00**

B. RF attenuator – impedance 75Ω, 16 .1dB steps for a range of 0-1.5dB, 250mW.
#DAVEN B **$10.00 each**

C. Delay line – impedance 75Ω 16 1NS steps for a range of 0-16.0NS, 1W. max. input.
#DAVEN C **$10.00 each**

D. RF attenuator – impedance 75Ω, 16 1dB steps for a range of 0-15dB, 125 mW.
#DAVEN D **$10.00 each**

We're selling these units for little more than their scrap value and they must have cost hundreds originally!!

A. UNIMAX SWITCH – DPDT 15 amp 125-250 vac. Notice the unusually high 15 amp rating of this switch. Can be used to control motors up to 1½ hp.
#US **3/$1.00**

B. Push on – push off SPST switch with 4" and 7" leads. U.S. made (Leviton).
#POPO **35¢ ea. 3/$1.00**

C. Rotary SPST switch w/41" leads and black and aluminum knob.
#CRS **50¢ ea. 3/$1.00**

D. Push-button switch, SPST momentary N.E. ¼A 250V, ¾A 125V. These switches are used in alarm systems and as reset switches in counters.
#DPS **3/$1.00 15/$3.50**

E. SPDT micro-toggle switch, U.S. made.
#ESM **$1.18 ea. 6/$5.00.**

F. DPDT micro-toggle as above.
#FMT **$1.55 ea. 10/$12.00**

G. Micro-slide switch, SPDT. ½ amp U.S. made.
#GMS **18¢ 10/$1.50**

H. Motor-driven cam switch, 120V, ½ RPM motor. 7 segment cam assembly with multiple contacts on each segment. Many sequential control applications.
#HMC **$4.50 ea. 2/$7.50**

J. Adjustable pressure actuated micro switch. Solid brass, chrome plated air cylinder. Knurled adjusting nut. SPST N.C. contacts.
#JAP **$1.25 ea. 5/$5.00**

K. SPST slide switch by Stackpole. 4 amp contacts. 15" red and black leads.
#KSS **$.25 ea. 5/$1.00**

### Copper Clad Boards

Epoxy copper clad board 1 cent per square inch perfect for hobbyist order as much or as little as you need, none smaller than 2" x 6".
Same new copper clad as above except pre drilled with arrays of D.I.P. IC and other holes. Make use of pre drilled areas or ignore and use as if blank. 72 cents square foot or 10 square feet $6.00.

New fresh Ferric chloride etch your own boards
$1.90 quart

### Hi-Voltage Power Supply

Due to an over inventory of these superb supplies, we can offer imported compact units for a very low price. This supply consists of a voltage doubling circuit with two 1 x 2 B tubes. All ceramic terminal boards, with lug type connections, and capacitor output. Frame grounded positive, but can be isolated: 5 KV and 10KV terminals are negative. Input 115 V ac., 60 Hz, 0.1 amp. Output 5 KV and 10 KV dc @ .5ma total load. Sh. wt. 10 lbs. Size: 3½" x 3" x 6".
#PSHV **$7.50**

A. 1/8 HP, 3600 RPM 115 VAC motor. Full induction-run ball bearing, Reversible, from one of America's largest producers of high speed line printers. 3/8" shaft. Used for grinder, buffing wheel, etc. Fantastic hobby motor bargain. Weight 8 lbs.
#J109 **$6.50**

B. Eagle Signal Co., variable cycle timer. Brand new in factory carton, quality mechanism with sessions 20 RPM 115 volt 60 Hz motor, gear train, magnetic clutch and 10 amp electric contacts.
#J194 Cycle timer **$4.00**

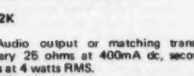
C. Power Supply
Handy basic power supply. 115 volts input and puts out approx. 18 volts dc at 1 amp. Also puts out a small 12V dc voltage designed to run symphonic home 8 trk tape players. Contains transformer, 5 diodes, 2 caps and 2 resistors.
#J122 power supply **$2.75**

### POWER AND OUTPUT TRANSFORMERS

A. Miniature power transformers – perfect size for digital clocks or other solid state projects. 1-5/16" x 1-1/8" x 1-5/8" P.C. mount. 115V. 60N input, 16V 260mA output.
#TA **$1.35**

B. Audio output or matching transformers. Primary 2000Ω, secondary 3.2Ω. 1½" x 1¼" x 1".
#AT2K **$.85**

C. Audio output or matching transformer. Primary 25 ohms at 400mA dc, secondary 4 ohms at 4 watts RMS.
#AT4W **2/$1.00**



**Fuses At An Old Fashioned 10¢ each**
**Choose from:**

| | | | |
|---|---|---|---|
| 1/8A | Slo-blo | Fig. a. | Clear |
| MDL | 2/10 A | Fig. d. | Slo-blo |
| MDL | 2 A | Fig. d. | Slo-blo |
| AGC | 1 A | Fig. d. | Standard |
| ABC | 3 A | Fig. e. | Ceramic tube |
| ABC | 5 A | Fig. e. | Ceramic tube |
| SFE | 6 A | Fig. h. | 7/8" long |
| SFE | 7½ A | Fig. h. | 7/8" long |
| SFE | 9 A | Fig. h. | 7/8" long |
| SFE | 14A | Fig. h. | 7/8" long |
| SFE | 30A | Fig. h. | |

## *SIMPLE KITS THAT ARE NOT TOYS BUT ARE REAL TOOLS TO USE . . .*

### LOGIC PROBE KIT

A. Our logic probe runs from the circuit under test and will indicate the presence of a high, low, floating, or pulse condition. The pulse catcher will indicate a 200NS pulse by lighting a led for ½ second. This easy to use probe will make trouble shooting digital IC circuits a snap. Kit includes 9 semiconductors, leads w/clips, P.C. board, capacitor, 3 resistors, probe tips and complete instructions.
#Logic **$12.00**

### CIPHER LOCK KIT

B. We designed this cipher lock for our alarm system but it got installed on a friend's motorcycle instead. Now there are many used on cars and motorcycles and one unit is on a high school locker. This 5 push cipher lock is the most efficient TTL lock circuit we've seen yet. Any keyboard or array of normally closed or normally open push buttons will work fine in this simple but very effective circuit. Power required 5VDC regulated @ 40 MA. Kit includes IC's, resistors, capacitors, keyboard and complete instructions.
#CL Kit – Cipher Lock Kit – Complete $10.50
#CL NK – Cipher Lock Kit less Keyboard – $4.50
#CL RR – Reed Relay for above – $1.00
#CL INST – Cipher Lock, instructions only – $1.00
#12 NW33 – Micro Switch Keyboard only – $6.50

### SOLVENT WELDING KIT

Our kit bonds acrylic, styrenes and other plastics together with a joint as strong as the original material. This easy-to-use kit includes:
- 1 oz. bottle methylene chloride (bonds better and stronger than acetone)
- Pipette
- 3 capillary tubes
- Metal scraping tool and sandpaper
- Full instructions

#SWK – Complete Kit – $2.00
#MC oz – 1 oz. Bottle Methylene Chloride Only – $1.00

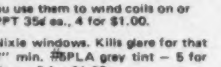
VERADA 214

VERADA 214

# TEST EQUIPMENT

**At last, here is industrial quality laboratory test equipment at prices you can afford. Most used equipment dealers sell gear like this, "reconditioned," for hundreds of dollars. Our policy is to sell it "as is" and let the purchaser make any necessary repairs, thus affording himself very considerable savings. Therefore, we do not represent our equipment as working (though much of it is), and calibrated. What we do say is that the equipment is complete and of reasonably good appearance, with physical damage, if any, limited to an occasional broken fuseholder, pilot lamp, etc. We believe you will be more than satisfied. Quantities are limited so order early.**

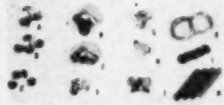
**Boonton Mod. 170A Q-Meter, 30-200 MHz ..... $20**
**Industrial Test Equipment Mod. 100A Null Phasemeter ..... $35**
**Millivac Mod. MV27 D.C. VTVM 25mv to 1kv ..... $20**
**Millivac Mod. MV18B R.F. VTVM and D.C. MilliVTVM ..... $18**
**Fluke Mod. 800 Differential Voltmeter ..... $40**
**Fluke Mod. 801 Differential Voltmeter ..... $40**
**Sprague Mod. LF-1 "Transimulator" for xstr circuit design ... $27**
**Non-Linear System Mod. 125E AC to DC Converter ..... $20**
**Non-Linear Systems Mod. M24 Digital Volt-Ohmmeter ..... $35**
**Tektronix Mod. 121 Wide Band Preamplifier ..... $18**
**Tektronix Mod. 122 Low Level Preamplifier ..... $18**
**Tektronix Mod. FM122 Low Level Preamplifier ..... $18**
**Dumont Mod. 185 Electronic Switch & Square Wave Generator .$19**
**TS4338/U Electronic Switch ..... $20**
**Sanborn RMS Volt/Amp Preamp with 150-600 power supply and carrying case ..... $30**
**Sanborn ac/dc preamp w/power supply & carrying case ..... $30**
**Sanborn Mod. 350-1400 Logarithmic preamp ..... $20**
**General Radio Mod. 1263A ampli. reg. power supply. Provides regulated output and 1kHz mod. for G.R. unit osc. ..... $40**
**Power Designs mod. 204-2 reg. power sup., 120-200vdc, 400ma .$25**
**Philbrick Research Mod. SR400 dual reg. power supply, ±250 to 350 vdc at 400 mA ..... $30**
**Harvey Radio Labs Mod. 160PA Reg. power supply ..... $16**
**Philbrick Research Mod. R100B dual power supply, ±300 vdc . .$20**
**Lambda Mod. LMFA4-0VY-2361 Reg. Power Supply, 4 volts dc, 30 Amp ..... $55**
**Lambda Mod. 28 reg. power supply, 200-325 vdc, 100 mA ..... $25**
**Lambda Mod. 29 reg. power supply ..... $25**
**Hewlett Packard mod. 710B power sup., 0-300 or 400vdc, 6.3vac $35**
**Lambda C281 power supply, 125-325 vdc, 200 mA ..... $20**
**Lambda C1581M Power Supply, 125-325 vdc, 1.5 Amp, and 6.5 vac. 30 Amp ..... $35**
**Singer Metrics Tuning Unit Mod. TS/NF-112-M, 10-15 KMHZ . .$18**
**Hewlett Packard Mod. 670HM SHF Oscillator, 7-10 KMHZ ....$35**
**Hewlett Packard Mod. 670SM SHF Oscillator, 2.6-4.0 KMHZ . . .$35**
**Polarad Mod. RL-T R.F. Tuning Unit, 950-2040 MHz ..... $30**
**Hewlett Packard Mod. 717A Klystron power supply ..... $30**
**Hewlett Packard Mod. 415B Standing wave indicator ..... $40**
**Hewlett Packard Mod. 415BR Standing wave indicator ..... $40**
**Hewlett Packard Mod. 430C Microwave power meter ..... $50**
**Hewlett Packard Mod. 430CR Microwave power meter ..... $50**
**Hewlett Packard Mod. 491A Traveling wave amplifier ..... $40**
**Hewlett Packard Mod. 492A Traveling wave amplifier ..... $40**
**Scott Microwave noise test system, type 123 MkIII, full 6' rack (see accompanying photograph) ..... $245**
**Hewlett Packard Mod. 100B low frequency standard ..... $55**
**Krohn-Hite Push-button oscillator, .01 Hz to 100 kHz ..... $34**
**Teletronics Mod. T025B test oscillator, 20 test frequencies, 400 Hz – 70 kHz ..... $25**
**Hewlett Packard Mod. 202D oscillator, 2 Hz to 70 kHz ..... $28**
**Hewlett Packard Mod. 200I oscillator, 6 Hz to 6300 Hz ..... $22**
**Boonton Mod. 71 square wave generator, 6 Hz to 100 kHz .... $23**
**Hewlett Packard Mod. 200T Precision telemetry oscillator, 2500 Hz to 33 kHz ..... $29**
**Electro-Mechanical Research Mod. 43 square wave generator, 6 Hz to 1 MHz ..... $19**
**Boonton Mod. 84 Standard pulse generator ..... $65**
**Lavoie Labs. Mod. LA593 pulse generator ..... $57**
**ElectroPulse Mod. 3450A Megacycle Pulse Generator ..... $28**
**ElectroPulse Mod. 2125B Pulse generator ..... $32**
**ElectroPulse Mod. 3420B Pulse oscillator ..... $30**
**Rutherford Electronics Mod. A-4 time delay generator ..... $22**
**Dumont Mod. 404 pulse generator ..... $40**
**Hewlett Packard Mod. 212A pulse generator ..... $75**
**Rutherford Electronics Mod. B7 pulse generator ..... $40**
**Teletronics Mod. PG200AA pulse generator ..... $37**
**Hewlett Packard Mod. 450A amplifier, 20 or 40 dB gain ..... $26**
**Cubic Mod. A-45 amplifier, gain x1, x10, x100 ..... $25**
**Brush Mod. BL932 D.C. amplifier ..... $28**
**General Radio Mod. 1862C, Megohmmeter, Like New, Working condition with manual ..... $75**
**Sorenson Mod. 1001 Line Voltage regulator, 1000va rating .... $85**
**Charles Engelhard Inc. Mod. 31777 Cathodic Equipment Protection Controller ..... $150**
**Kilovolt Corp. Giant High Voltage Transformer. Primary 105/115/125 60 cycle, single phase. Output, 60,000 volts @ 2.5 KVA. Shock your friends ..... $75**



**A** Phenolic potting tube 1-5/16" O.D., 1-1/8" I.D. x 8" long. Transitron used them to pot large diode arrays. You use them to wind coils on or pot circuits inside. #PT 35¢ ea., 4 for $1.00.

**B&C** Tinted plastic Nixie windows. Kills glare for that pro-look. 1-3/4" x 7" min. #PLA grey tint – 5 for $1.00, #PLB light blue – 5 for $1.00.

**D** Cabinet Handle. Made from strong high impact polystyrene. (Black) with mounting screws. Mounting holes 6" on center. #CH 65¢, 2 for $1.00.



**A&B** Nylon cabinet glides. Just pound in with a hammer. Use them on speaker cabinets or any wooden item. Both 5/8" dia.
**A** Round tan #NGA.

**B** Squared it. brown #WGB, 4 for 28¢, 20 for $1.00.

**C** Molded rubber feet. You attach these with a small screw through the center, or pop-rivet them to an aluminum chasis. #MR4 for 28¢, 20 for $1.00

**D-J** Protective Chrome Corners Hard to find speaker and sample case hardware. We can make these available to you at a fraction of hardware store prices due to the large number we purchase and use in our own shop. Use them to protect and beautify all your cabinets.

**D, F&G** Mount with 3 screws.

**E, H&J** Use 2 screws and allow 3rd face to be removable.

**D** #3069 over 2" for 3/4" stock 50¢ ea. 8 for $3.25, 100 for $22.00.

**E** #3069-1 Open faced model of D, 55¢ ea. 8 for $3.50, 100 for $23.00.

**F** #3209 approx. 1¼" can be used on cabinets with square corners. 20¢ ea., 8 for $1.45, 100 for $8.00.

**G** #6210 approx. 1½" larger version of F. 25¢ ea., 8 for $1.90, 100 for $11.00.

**H** #8050½ open faced model of G, 35¢ ea., 8 for $2.50, 100 for $12.50.

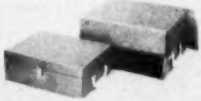
**J** #8053-5/8 modern corner saver with open face. 35¢ ea., 8 for $2.50, 100 for $12.50.

**K** Hole neatner. 1-1/4" I.D., 1-7/16" O.D. rim x 1/2" deep. These large steel grommets are used to protect cables passed through wooden panels. #HN. 12¢ ea., 10 for $1.00.

**L** Felt washers. Here's another hard to find item with many used in all types of gear. 5/8" dia. x 3/16" thick with 1/8"hole. #W, 5 for 20¢, 30 for $1.00.

**M** Furniture repair kit with instructions. This kit includes 4 blend sticks for repairing dents, nickand gouges by filling in and coloring. #FRK 65¢, 2 for $1.00.

## PORTABLE INSTRUMENT CASES



We have just bought hundreds of these brand new wooden carrying cases. They should be perfect for all kinds of portable equipment, transceivers, direction finding gear, test equipment, etc. Smaller size is 12-3/8 x 9-5/8 x 4-5/8 with textured green/gold covering. Larger size is 13-7/8 x 12-5/8 x 7-1/2 with textured blue/silver covering. Both have sturdy steel clasps and hinges and white plastic handles. #SPIC Smaller Case $3.25; #LPIC Larger Case $4.50.

**Attractive Walnut/ Aluminum Cabinet**

Ideal for digital clocks, stereo amps, preamps etc. Simple assembly assures easy access. Four screws through rubber feet hold this neat little cabinet together without unsightly screws showing. Dimensions 9-3/8W x 6-1/2D x 2-3/4H
**Order #Cabinet A $7.50 each**

We are offering a brand new line of inexpensive decorator cabinets for home projects. Now you can EASILY build things that look like they belong on the mantelpiece instead of the workbench. Do you really want a GRAY HAMMERTONE digital clock in your living room? All cabinets are constructed from wood-grained, vinyl covered particle board and sheet aluminum. This makes them easy to clean, tough, rust proof and attractive. Protective rubber feet are included, of course. The potential uses for these cabinets are limited only by your imagination. Anything you would have once built in a mini-box, you can now afford to put in a professional looking enclosure. Just a few of the possible applications: Intercoms; Digital clocks; Synthesizers; Amplifiers; Digital thermometers; Frequency counters; Switch panels; Tuners; Preamps; Power supplies; Equalizers; and Transceivers.

*Write for more data on the cabinets or see next month's 73 Magazine for our ad.*

VERADA 214

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| 222.34 | 223.90 | 146.10 | 146.52 | 52.525 | 52.525 |
| 222.38 | 223.94 | 146.12 | 146.61 | 52.70 | 52.60 |
| 223.14 | 223.98 | 146.16 | 146.70 | 52.76 | 52.64 |
| 223.26 | 224.74 | 146.19 | 146.72 | 52.82 | 52.68 |
| 223.30 | 224.86 | 146.22 | 146.76 | 52.88 | 52.72 |
| 223.34 | 224.90 | 146.25 | 146.79 | 52.92 | 52.79 |
| 223.50 | 224.94 | 146.28 | 146.82 | 52.96 | 52.80 |
| | | 146.34 | 146.85 | 53.15 | 53.05 |
| | | 146.52 | 146.88 | 53.25 | 53.08 |
| | | 146.94 | 146.94 | 53.68 | 53.16 |

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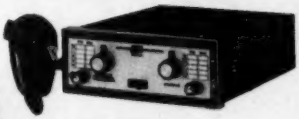

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| 7406 | .39 | 7486 | .44 | 74192 | 1.35 |
| 7407 | .39 | 7488 | 3.00 | 74193 | 1.35 |
| 7408 | .25 | 7489 | 2.75 | 74194 | 1.39 |
| 7409 | .25 | 7490 | .79 | 74195 | .95 |
| 7410 | .19 | 7491 | 1.29 | 74196 | 1.25 |
| 7411 | .29 | 7492 | .79 | 74197 | .99 |
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| 7425 | .39 | 74123 | .99 | | |
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| 7427 | .35 | 74126 | .79 | | |
| 7429 | .40 | 74141 | 1.15 | | |
| 7430 | .22 | 74145 | 1.10 | | |
| 7432 | .29 | 74150 | 1.05 | | |
| 7437 | .45 | 74151 | .89 | | |
| 7438 | .39 | 74153 | 1.29 | | |
| 7439 | .50 | 74154 | 1.25 | | |
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| 7441 | 1.08 | 74156 | 1.29 | | |
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| CD4023 | .55 |
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**Basic Kit Includes: PRICE (basic kit) $349.50**

A printed circuit boards (compatible with 22 pin edge connectors – not supplied)
B microprocessor chip set
C gates, interface elements, clock drivers, etc.
D transistors, diodes, capacitors
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2 memory board #1 (employs 1101 rams)
3 memory board #2 (employs 1101 rams and 5203 erasible PROMS)

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available separately
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| 7402 | .19 | 7450 | .24 | 74150 | 1.09 |
| 7403 | .19 | 7451 | .27 | 74151 | .89 |
| 7404 | .32 | 7453 | .27 | 74153 | 1.29 |
| 7405 | .22 | 7454 | .39 | 74154 | 1.59 |
| 7406 | .39 | 7460 | .19 | 74155 | 1.19 |
| 7407 | .39 | 7464 | .39 | 74156 | 1.29 |
| 7408 | .25 | 7465 | .89 | 74157 | 1.29 |
| 7409 | .25 | 7472 | .36 | 74161 | 1.39 |
| 7410 | .19 | 7473 | .43 | 74163 | 1.59 |
| 7411 | .29 | 7474 | .43 | 74164 | 1.89 |
| 7413 | .79 | 7475 | .75 | 74165 | 1.89 |
| 7415 | .39 | 7476 | .47 | 74166 | 1.65 |
| 7416 | .39 | 7483 | 1.11 | 74173 | 1.65 |
| 7417 | .39 | 7485 | 1.39 | 74176 | 1.61 |
| 7420 | .19 | 7486 | .44 | 74177 | .99 |
| 7422 | .29 | 7489 | 2.75 | 74180 | 1.09 |
| 7423 | .35 | 7490 | .76 | 74181 | 3.65 |
| 7425 | .39 | 7491 | 1.29 | 74182 | .89 |
| 7426 | .29 | 7492 | .79 | 74184 | 2.69 |
| 7427 | .35 | 7493 | .79 | 74185 | 2.19 |
| 7430 | .22 | 7494 | .89 | 74190 | 1.59 |
| 7432 | .29 | 7495 | .89 | 74191 | 1.59 |
| 7437 | .45 | 7496 | .89 | 74192 | 1.49 |
| 7438 | .39 | 74100 | 1.65 | 74193 | 1.39 |
| 7440 | .19 | 74105 | .49 | 74194 | 1.39 |
| 7441 | 1.09 | 74107 | .49 | 74195 | .99 |
| 7442 | .99 | 74121 | .57 | 74196 | 1.01 |
| 7443 | .99 | 74122 | .53 | 74197 | .99 |
| 7444 | 1.10 | 74123 | .99 | 74198 | 2.19 |
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| 74L00 | .33 | 74L51 | .33 | 74L90 | 1.69 |
| 74L02 | .33 | 74L55 | .33 | 74L91 | 1.45 |
| 74L03 | .33 | 74L71 | .33 | 74L93 | 1.69 |
| 74L04 | .33 | 74L72 | .49 | 74L95 | 1.69 |
| 74L06 | .33 | 74L73 | .69 | 74L98 | 2.79 |
| 74L10 | .33 | 74L74 | .69 | 74L164 | 2.79 |
| 74L20 | .33 | 74L78 | .79 | 74L165 | 2.79 |
| 74L30 | .33 | 74L85 | 1.25 | | |
| 74L42 | 1.69 | 74L86 | .69 | | |

**HIGH SPEED TTL**

| | | | | | |
|---|---|---|---|---|---|
| 74H00 | .33 | 74H21 | .33 | 74H55 | .39 |
| 74H01 | .33 | 74H22 | .33 | 74H60 | .39 |
| 74H04 | .33 | 74H30 | .33 | 74H61 | .39 |
| 74H08 | .33 | 74H40 | .33 | 74H62 | .39 |
| 74H10 | .33 | 74H50 | .33 | 74H72 | .49 |
| 74H11 | .33 | 74H52 | .33 | 74H74 | .59 |
| 74H20 | .33 | 74H53 | .39 | 74H76 | .59 |

**8000 SERIES TTL**

| | | | | | |
|---|---|---|---|---|---|
| 8091 | .59 | 8214 | 1.69 | 8811 | .69 |
| 8092 | .59 | 8220 | 1.69 | 8812 | 1.10 |
| 8095 | 1.39 | 8230 | 2.59 | 8822 | 2.59 |
| 8121 | .89 | 8520 | 1.29 | 8830 | 2.59 |
| 8123 | 1.59 | 8551 | 1.65 | 8831 | 2.59 |
| 8130 | 2.19 | 8552 | 2.49 | 8836 | .49 |
| 8200 | 2.59 | 8554 | 2.49 | 8880 | 1.33 |
| 8210 | 3.49 | 8810 | .79 | | |

**9000 SERIES TTL**

| | | | | | |
|---|---|---|---|---|---|
| 9082 | .39 | 9309 | .89 | 9601 | .99 |
| 9301 | 1.14 | 9312 | .89 | 9602 | .89 |

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### CMOS

| | | | | | |
|---|---|---|---|---|---|
| 74C00 | .39 | 74C74 | 1.15 | 74C162 | 3.25 |
| 74C02 | .55 | 74C76 | 1.70 | 74C163 | 3.25 |
| 74C04 | .75 | 74C107 | 1.50 | 74C164 | 3.50 |
| 74C08 | .75 | 74C151 | 2.90 | 74C173 | 2.90 |
| 74C10 | .65 | 74C154 | 3.50 | 74C195 | 3.00 |
| 74C20 | .65 | 74C157 | 2.19 | 80C95 | 1.50 |
| 74C42 | 2.15 | 74C160 | 3.25 | 80C97 | 1.50 |
| 74C73 | 1.55 | 74C161 | 3.25 | | |

## JANUARY SPECIALS

| | | | | | |
|---|---|---|---|---|---|
| 7406 | Hex inverter DIP | $ .35 | 301 | Hi perf amplifier mini-dip | $ .19 |
| 7440 | Dual 4 input buffer DIP | .17 | 380 | 2W audio amp DIP | 1.35 |
| 7464 | AND OR INVERT gate DIP | .23 | 3900 | Quad amplifier DIP | .39 |
| 74164 | Serial in parallel out 8 bit shift register DIP | 1.69 | 1103 | 1024-bit dynamic RAM MOS 18 pin DIP | 2.95 |
| 7474 | Dual D flip-flop DIP | .29 | 5260 | 1024-bit dynamic RAM MOS low power 16 pin DIP | 2.95 |
| 74125 | Tri state quad buffer DIP | .55 | 5316 | 6 digit, 50-60 Hz, 12-24 hr., alarm-snooze alarm, presettable sleep timer 40 pin DIP | 6.95 |
| 74175 | Quad D flip-flop w/clear DIP | 1.80 | | | |
| 8230 | Tri state 2-4 line demultiplexer DIP | 1.95 | | | |
| 8830 | Dual line driver | 1.75 | | | |
| 8836 | Quad 2 input receiver | .25 | MAN66 | Red, spaced seg, .8"-common anode-LH dec (sp anode)-14 pin DIP | 3.95 |

### MEMORIES

| | | |
|---|---|---|
| 1101 | 256 bit RAM MOS | 1.75 |
| 1103 | 1024 bit RAM MOS | 4.95 |
| 5260 | 1024 bit RAM Low Power | 3.95 |
| 7489 | 64 bit RAM TTL | 2.75 |
| 6223 | Programmable ROM | 4.95 |

### CALCULATOR & CLOCK CHIPS w/data

| | | |
|---|---|---|
| 5001 | 12 DIG 4 funct fix dec | 3.95 |
| 5002 | Same as 5001 exc bdry pwr | 7.95 |
| 5005 | 12 DIG 4 funct w/mem | 8.45 |
| MM5725 | 8 DIG 4 funct chain & dec | 2.79 |
| MM5738 | 10 pin 6 DIG 4 funct | 4.95 |
| MM5738 | 8 DIG 5 funct K & Mem | 7.95 |
| MM5738 | 9 DIG 4 funct (bdry scr) | 6.95 |
| MM 5311 | 28 pin BCD 6 dig mux | 9.95 |
| MM 5312 | 24 pin 1 pps BCD 4 dig mux | 6.95 |
| MM 5313 | 28 pin 1 pps BCD 6 dig mux | 7.95 |
| MM 5314 | 24 pin 6 dig mux | 8.95 |
| MM 5316 | 40 pin alarm 6 dig | 8.95 |

### LED & OPTO ISOLATORS

| | | |
|---|---|---|
| MV10B | Red TO 18 | $ .35 ea. |
| MV50 | Axial leads | .20 |
| MV5020 | Jumbo Vis. Red (Red Dome) | .33 |
| | Jumbo Vis. Red (Clear Dome) | .33 |
| ME4 | Infra red diff. dome | .80 |
| MAN1 | Red 7 seg. .270" | 2.50 |
| MAN2 | Red alpha num .32" | 4.95 |
| MAN3A | Red 7 seg. .127" | .79 |
| MAN3M | Red 7 seg. .127" cmn | 1.15 |
| MAN4 | Red 7 seg. .180" | 2.15 |
| MAN5 | Green 7 seg. .270" | 2.95 |
| MAN6 | .6" high solid seg | 6.95 |
| MAN7 | Red 7 seg. .270" | 1.35 |
| MAN8 | Yellow 7 seg. .270" | 3.95 |
| MAN64 | .4" high solid seg | 4.50 |
| MAN80 | .6" high spaced seg | 4.95 |
| DL707 | Red 7 seg. .3" | 2.15 |
| MCD2 | Opto-iso diodes | 1.00 |
| MCT2 | Opto-iso transistor | .69 |

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| | | | | | |
|---|---|---|---|---|---|
| 930 | $ .17 | 937 | $ .17 | 949 | $ .17 |
| 932 | .17 | 944 | .17 | 962 | .17 |
| 936 | .17 | 948 | .17 | 963 | .17 |

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| | | | | | |
|---|---|---|---|---|---|
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| CD4009 | .95 | CD4016 | 1.25 | CD4025 | .55 |
| CD4010 | .95 | CD4017 | 2.95 | CD4027 | 1.35 |
| CD4011 | .55 | CD4018 | 1.35 | CD4030 | .95 |
| CD4012 | .55 | CD4022 | 2.75 | CD4035 | 2.85 |

### LINEAR CIRCUITS

| | | | |
|---|---|---|---|
| 300 | Pos V Reg (super 723) | TO-5 | .79 |
| 301 | Hi Perf | mDIP TO-5 | .32 |
| 302 | Volt follower | TO-5 | .79 |
| 304 | Neg V Reg | TO-5 | .89 |
| 305 | Pos V Reg | TO-5 | .95 |
| 307 | Op AMP (super 741) | mDIP TO-5 | .35 |
| 308 | Micro Pwr Op Amp | mDIP TO-5 | 1.10 |
| 309K | 5V 1A regulator | TO-3 | 1.65 |
| 310 | V Follower Op Amp | TO-5 mDIP | 1.19 |
| 311 | Hi perf V Comp | mDIP TO-5 | 1.05 |
| 319 | Hi Speed Dual Comp | DIP | 1.29 |
| 320 | Neg Reg 5.2, 12, 15 | TO-3 | 1.35 |
| 324 | Quad Op Amp | DIP | 1.95 |
| 339 | Quad Comparator | DIP | 1.69 |
| 340T | Pot Volt Reg (6V-8V-12V-15V-18V-24V) | TO-220 | 1.95 |
| 370 | AGC/Squelch AMPL | TO-5 or DIP | 1.15 |
| 372 | AF-IF Strip-detector | DIP | .79 |
| 373 | AM/FM/SSB Strip | DIP | 3.25 |
| 376 | Pos. V Reg | mDIP | .59 |
| 377 | 2w Stereo amp | DIP | 2.69 |
| 380 | 2w Audio Amp | DIP | 1.49 |
| 380-8 | .5w Audio amp | mDIP | 1.25 |
| 381 | Lo Noise Dual preamp | DIP | 1.79 |
| 382 | Lo Noise Dual preamp | DIP | 1.79 |
| 550 | Pres V Reg | DIP | .79 |
| 555 | Timer | mDIP | .99 |
| 560 | Phase Locked Loop | DIP | 2.75 |
| 562 | Phase Locked Loop | DIP | 2.75 |
| 565 | Phase Locked Loop | DIP TO-5 | 2.65 |
| 566 | Function Gen | mDIP TO-5 | 2.75 |
| 567 | Tone Gen | mDIP | 2.95 |
| 709 | Operational AMPL | TO-5 or DIP | .29 |
| 710 | Hi Speed Volt Comp | DIP | .39 |
| 711 | Dual Difference Compar | DIP | .29 |
| 723 | V Reg | DIP | .69 |
| 739 | Dual Hi Perf Op Amp | DIP | 1.19 |
| 741 | Comp Op AMP | mDIP TO-5 | .35 |
| 747 | Dual 741 Op Amp | DIP or TO-5 | .79 |
| 748 | Freq Adj 741 | mDIP | .39 |
| 1304 | FM Multpx Stereo Demod | DIP | 1.19 |
| 1307 | FM Multpx Stereo Demod | DIP | .82 |
| 1458 | Dual Comp Op Amp | mDIP | .69 |
| LH2111 | Dual LM 211 V Comp | DIP | 1.95 |
| 3089 | TV-FM Sound System | DIP | .89 |
| 3075 | FM Det-LMTR & Audio preamp | DIP | .79 |
| 3900 | Quad Amplifier | DIP | .59 |
| 3905 | Precision Timer | DIP | .65 |
| 7524 | Core Mem Sense AMPL | DIP | 1.00 |
| 7534 | Core Mem Sense Amp | DIP | 2.59 |
| 8038 | Function Gen | DIP | 5.95 |
| 8864 | 9 DIG Lat Cath Dvr | DIP | 2.50 |
| 75451 | Dual Peripheral Driver | mDIP | .39 |
| 75452 | Dual Peripheral Driver | mDIP | .39 |
| 75453 | (3611) Dual Periph. Driver | mDIP | .39 |
| 75491 | Quad Seg Driver for LED | DIP | .79 |
| 75492 | Hex Digit Driver | DIP | .89 |

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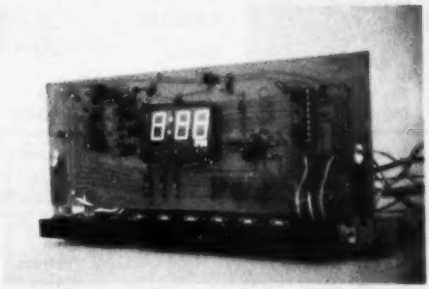

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| 7440 | .25 | 7493 | 1.15 |
| 74H40 | .35 | 7495 | 1.15 |
| 7441 | 1.25 | 74L95 | 2.00 |
| 7442 | 1.20 | 74107 | .70 |
| 7447 | 1.50 | 74145 | 1.20 |
| 7450 | .25 | 74180 | 1.25 |
| 74H50 | .35 | 74193 | 1.50 |
| 7451 | .25 | 74195 | 1.00 |
| 74L51 | .30 | | |

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*DATA SHEET SUPPLIED*

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10 OR MORE $1.00 EA

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7-Segment, 0-9 plus letters. Right-hand decimal point. Snaps in 14-pin DIP socket or Molex. IC voltage requirements. Ideal for desk or pocket calculators!

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This kit provides a highly sophisticated display section module for clocks, counters, or other numerical display needs. The unit is .8" wide and 4 3/8" long. A single 5-volt power source powers both the ICs and the display tube. It can attain typical count rates of up to 30 MHz and also has a lamp test, causing all 7 segments to light. Kit includes a 2-sided (with plated thru holes) fiberglass printed circuit board, a 7490, a 7475, a 7447, a DR2010 RCA Numitron display tube, complete instructions, and enough MOLEX pins for the ICs... NOTE: boards can be supplied in a single panel of up to 10 digits (with all interconnects); therefore, when ordering, please specify whether you want them in single panels or in one multiple digit board. Not specifying will result in shipping delay.

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FULLY-ASSEMBLED UNIT $15.00

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## L I N E A R S

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| NE560 | Phase lock loop DIP | 3.25 |
| NE561 | Phase lock loop DIP | 3.25 |
| NE565 | Phase lock loop TO-5 | 3.25 |
| NE566 | Function generator TO-5 | 4.00 |
| NE567 | Tone decoder TO-5 | 3.00 |
| 709 | Popular Op Amp DIP | .45 |
| 710 | Voltage comparator DIP | .75 |
| 711 | Dual comparator DIP | .40 |
| 723 | Precision voltage regulator DIP | 1.00 |
| 741 | Op amp TO-5/MINI DIP | .55 |
| 747 | Dual 741 op amp DIP | 1.50 |
| 748 | Op Amp TO-5 | 1.00 |
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| CA3026 | Dual differential amp | 1.00 |
| CA3045 | 5 NPN transistor array | 1.00 |
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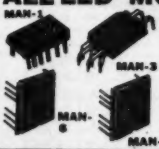


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| AUSTRALIA | 14 | 7B | 7B | 7B | 7 | 7 | 3B | 7 | 14 | 14B | 14 | 14 |
| CANAL ZONE | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 14 | 14A | 14A | 14 | 14 |
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| HAWAII | 14 | 7B | 7 | 3 | 3 | 3 | 3 | 3 | 7B | 14 | 14A | 14A |
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| JAPAN | 14 | 7B | 7B | 3 | 3 | 3 | 3 | 3 | 3B | 3B | 7 | 7A |
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| ARGENTINA | 14 | 7B | 7 | 7 | 7 | 7 | 7B | 14 | 14 | 14 | 14 | 14A |
| AUSTRALIA | 14 | 14 | 7B | 7B | 7 | 7 | 3B | 7 | 14 | 14B | 14 | 14 |
| CANAL ZONE | 14 | 7 | 7 | 7 | 7 | 7 | 7 | 14 | 14 | 14A | 14A | 14A |
| ENGLAND | 7 | 3 | 3 | 3 | 3 | 3 | 3B | 7A | 14 | 14 | 7B | 7 |
| HAWAII | 14 | 7B | 7 | 3 | 3 | 3 | 3 | 3 | 7 | 14 | 14A | 21 |
| INDIA | 3 | 7 | 3B | 3B | 3B | 3B | 3B | 7 | 7A | 7 | 7B | 7 |
| JAPAN | 14 | 7B | 7 | 3 | 3 | 3 | 3 | 3 | 3 | 3B | 7 | 14 |
| MEXICO | 7A | 7 | 3 | 3 | 3 | 3 | 3 | 7 | 14 | 14 | 14 | 14 |
| PHILIPPINES | 14 | 7B | 3B | 3B | 3B | 3 | 3 | 3 | 7 | 7 | 3B | 7 |
| PUERTO RICO | 14 | 7 | 7 | 7 | 7 | 3 | 7 | 14 | 14 | 14A | 14A | 14 |
| SOUTH AFRICA | 7A | 7 | 3A | 3A | 3A | 3B | 7B | 14 | 14A | 14 | 14 | 14 |
| U. S. S. R. | 3 | 3 | 3 | 3 | 3 | 3B | 3B | 7A | 7A | 7B | 3B | 3B |

### WESTERN UNITED STATES TO:

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALASKA | 14 | 7 | 7 | 3 | 3 | 3 | 3 | 3 | 7 | 7 | 14 | 14 |
| ARGENTINA | 14 | 7B | 7 | 7 | 7 | 7 | 7B | 7B | 14 | 14 | 14 | 14A |
| AUSTRALIA | 14A | 14A | 14 | 7B | 7 | 7 | 7 | 3B | 7 | 7A | 14 | 14 |
| CANAL ZONE | 14 | 7 | 7 | 7 | 7 | 7 | 3 | 7A | 14 | 14A | 14A | 14A |
| ENGLAND | 7 | 3 | 3 | 3 | 3 | 3 | 3B | 7 | 14 | 14 | 7B | 7B |
| HAWAII | 14 | 14 | 14 | 7 | 7 | 7 | 7 | 3 | 7 | 14 | 21 | 21 |
| INDIA | 3 | 14 | 3B | 3B | 3B | 3B | 3 | 3 | 7 | 7 | 7 | 7B |
| JAPAN | 14 | 14 | 7B | 3 | 3 | 3 | 3 | 3 | 3A | 3A | 7 | 14 |
| MEXICO | 14 | 7 | 3 | 3 | 3 | 3 | 3 | 7 | 14 | 14 | 14A | 14 |
| PHILIPPINES | 14 | 14 | 7B | 3B | 3B | 3 | 3 | 3 | 7 | 7 | 7B | 14 |
| PUERTO RICO | 14 | 7 | 7 | 3 | 7 | 3 | 3 | 7A | 14 | 21 | 21 | 14 |
| SOUTH AFRICA | 14 | 7 | 3A | 3 | 3A | 3A | 3B | 7B | 14 | 14 | 14 | 14 |
| U. S. S. R. | 3 | 3 | 3 | 3 | 3 | 3B | 3B | 3 | 7 | 7 | 3B | 3B |
| EAST COAST | 14 | 7 | 7 | 3 | 7 | 7 | 3 | 7 | 14 | 14A | 14A | 14A |

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

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